PARK DESIGN GUIDELINES

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Date: November, 1983

ACKNOWLEDGEMENTS

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INTRODUCTION

The primary objective of the Park Design Guidelines manual is to provide specific information on the design of park facilities and to provide assistance to all those involved in the planning, development and operation of parks.

The manual includes data on the planning and design of all major park facilities, from beaches to trails. The manual is divided into chapters, each of which covers a particular facility. Each chapter is further divided into two sections. The first section is a "fact sheet" of key design information for that particular facility, i.e. dimensions, orientation, etc. The second section is a generalized, informational discussion of such issues as alternative layouts, safety, and other components of the facility.

This manual alone cannot assure good design. It does, however, set down a solid foundation for it, and provides the tools to aid in the design and development processes. It is important to remember that these guidelines are not set rules, for every design situation will present different problems which cannot and should not be standardized.

The data presented has been gathered from a number of sources on park design standards and facility design in order to gain as many different perspectives as was reasonably possible.

1. DAY-USE AREAS

objective:

to provide areas with suitable facilities for people to picnic.

1.0 DAY-USE AREAS (PICNIC AREAS):

- minimum area per picnic unit 20.25 m^2 for 3-8 people;
- maximum unit density is 25-125 tables per hectare;
- recommended unit density is 20-37 tables per hectare;
- distance between picnic units should be a minimum of 12 m on centre 30 m recommended (if low density required);
- for every picnic site at day-use area, provide a minimum of 1 1/2 parking stalls for vehicles;
- provide 30 m^2 minimum per parking stall;
- minimum area for group picnic site is 0.8 hectares;
- provide a parking lot for at least 15 cars and 2 buses for every group picnic site;
- slope for picnic unit 2%-15% with a maximum of 20%;
- drinking water should be within 45 m of all units;
- maximum distance to sanitary facilities is 180 m;
- for every 4 picnic units, provide a waste receptacle within 45 m of each table;
- 75-90 m recommended distance from parking lot to furthest picnic unit, 120 m is maximum distance.

1.1 GENERAL:

- day-use areas are those areas in which the user participates during a portion of the day or evening, but does not require on-site overnight accommodation;
- normally users originate from a distance within 1 1/2 hours driving time from the activity area;
- it is important that picnic sites be in an area that can sustain compaction and still retain the desired vegetative character;
- picnickers in groups prefer picnic shelters, and vehicular access is necessary to drop-off supplies and equipment;
- provide other facilities and activities such as playing fields, beaches, playgrounds, etc. in association with picnic areas.

1.2 VEHICULAR ACCESS AND PARKING:

- 3.6-6.0 m wide entry road recommended;
- keep traffic moving into and out of the parking lot in one direction; this lessens the potential danger for pedestrians;
- material should be all-weather surface, i.e. gravel;
- service roads should be 2.4 m wide, and can serve as trails within day-use areas;
- locate the parking lot in such a way as to minimize any visual intrusion for the day-use area;
- provide area for overflow parking, if necessary;
- regular lot should be all-weather surface;
- the size of the parking lot is determined by calculating the average heavy-use day and providing for the extra holiday or heaviest-day parking as overflow;
- parking can act as a control over the use of day-use areas if it is restricted to designated areas;
- recommend the use of 2 or 3 central parking lots rather than several smaller lots;
- planting strips, oriented east to west, can visually break up the lot as well as provide shade.

1.3 INDIVIDUAL PICNIC SITES:

- in heavily used areas, the picnic tables should be anchored to the ground;
- in moderate to low-use areas, moveable or fixed furniture can be used;
- provide areas that are shaded from 11:00 a.m. to 5:00 p.m.;
- requirements at each site include a picnic table, a barbecue or cooking facility and firewood;
- group units in clusters of 3-5 for lower construction costs and easier maintenance.

1.4 GROUP PICNIC SITES:

- should be separate from general-use areas;
- locate adjacent to other activity areas;
- requirements: picnic table, barbecue/cooking facility, firewood, water, small shelter, sanitary facilities, and parking for large vehicles;
- provide vehicular access to the shelter for servicing;
- provide enough picnic tables to allow 75% of the group to be seated at one time;
- consider providing a fire ring;
- provide shaded areas;
- if the area is to be used in the evening, trails and sites should be well marked and maintained.

1.5 EN-ROUTE PICNIC SITES:

- generally are provided for highway travellers;
- tables should be grouped in evenly spaced clusters;
- requirements: picnic table, sanitary facilities, drinking water, and a safe place to pull off from the highway;
- cooking facilities are not included because at these sites, rapid turnover is intended;
- recommend providing flush toilets at these sites.

1.6 BOAT-IN/WALK-IN SITES:

- these retain the primitive character of the site;
- similar to individual picnic sites, but not accessible by vehicle;
- provide some clearing on site, either along the shoreline for boat access, or in the form of a trail to the site;
- provide a picnic table, fire ring and trash receptable;
- the total area is small and should accommodate only a few units;
- provide sanitary facilities, either watertight pit privy or a chemical toilet;
- drinking water is not supplied, other than what exists naturally at site (river, lake);
- should provide for servicing by boat or vehicle to the sites.

1.7 SELECTED REFERENCES:

U.S. Department of the Interior. Bureau of Outdoor Recreation. Outdoor Space Standards. Washington D.C.: U.S. Government Printing Office, 1967.

Ontario Ministry of Natural Resources, Division of Parks. Ontario Provincial Parks Landscape Design Principles and Guidelines. n.p.: Ontario Ministry of Natural Resources, 1977.

Douglass, Robert W. Forest Recreation. New York: Pergamon Press Inc., 1975.

Fogg, George E. Park Planning Guidelines. n.p.: National Society for Park Resources, 1975.

2. BEACHES

objective:

to provide an area suitable for swimming and associated activities such as sunbathing and sitting.

2.0 BEACHES:

- sand beaches are generally preferred because the gentle slope into the water provides safe conditions for children and a space for being in or near the water;
- slope underwater 2-15%;
- the beach should have a uniform and gentle slope to a water depth of 1.8 m;
- backshore, grassed area 10% slope maximum;
- high density beach-9 m^2 of dry beach per person;
- medium density beach-23 m^2 of dry beach per person;
- low density beach-46 m^2 of dry beach per person;
- east, south, and west facing beach orientations preferred;
- should be situated so prevailing winds blow towards the shore, drawing in the warmed surface water toward the bathing area and creating a breeze to discourage insects at beach;
- distance to sanitary facilities 15-30 m depending on type, 150 m maximum distance;
- lifeguard chairs 120 m on center;
- safety floats (buoys) 45 m from shoreline or depth of 1.83 m;
- size of parking lot is determined by beach capacity and if it shares the lot usage with other facilities;
- parking lot should be a maximum of 240 m from the beach, 150 m is more desirable distance;
- parking capacity should be greater than actual beach capacity, i.e. for spectators, etc.

2.1 GENERAL:

- where a natural beach exists, care must be taken to protect the vegetation edge in order to prevent erosion of the backshore by providing boardwalks, defined trails, etc.;
- possible to share facilities (i.e. parking lots, sanitary facilities) with other activity areas, i.e. picnic grounds;
- safety of user is of prime importance;
- quality of the water must be sufficiently high to be considered safe for swimming (low bacterial count), i.e. less than 1,000 coliform organisms per 100 millilitres of water;
- all physical hazards (either submerged, at waters edge or in the water) should be removed, improved, or properly signed to warn user;
- provide shaded areas on backshore for those users wishing to get out of direct sun.

2.2 ACCESS AND PARKING:

- vehicular access to parking lot, can be either one-way or two-way, all weather road;
- access to the beach can be either direct from parking lot, or via a trail, depending on conditions;
- parking should be within easy walking distance;
- provide shaded cover for parking lot.

2.3 OTHER COMPONENTS:

- number of sanitary facilities dependent on population;

no. of males	urinals	toilets	lavatory	showers	change rooms
1-50	1	1	1	1	1
51-100	1	1	1	2	2
101-250	2	2	2	3	4
251-500	3	2	2	4	6
501-750	3	3	3	4	7
751-1000	4	3	3	5	8
1001-1500	5	4	4	6	10
1501-2000	6	5	5	7	12

no. of females	toilets	lavatory	showers	change rooms
1-50	1	1	1	1
51-100	2	1	2	2
101-250	3	2	3	4
251-500	5	2	4	6
501-750	6	3	4	8
751-1000	7	3	5	9
1001-1500	9	5	6	11
1501-2000	11	5	7	13

- consider the provision of food services at major beaches;
- where food is to be prohibited on beaches, consider providing a definite visible point such as a walk or grade separation beyond which no food is allowed;
- provision of food services can range from a vending machine to a snack bar to a restaurant;
- locate at a minimum 75-150 m from water's edge;
- integrate restrooms and dressing rooms with food service area;
- where picnic and beach combinations are planned, the dressing rooms should be located between the picnic area and the beach;
- wherever possible, dressing rooms should be combined with sanitary facilities and showers;
- drinking fountains should be located as necessary, with 250 m spacing between each;

- desirable to designate activities and set aside areas for various recreation activities, such as children's playground, volleyball courts, turf fields;
- locate these to the back, or off to the sides of the main beach area;
- locate between facilities, i.e. picnic grounds and beach, so both can share in use of facilities;
- boat rentals often desirable at beaches, provide at periphery of beach;
- if fire rings are provided on the beach, should be placed in groups away from swimming area, at back or sides of the beach;
- fire rings should be 30 m apart;
- consider fire rings only on beaches that are open for evening use;
- lifeguard buildings should have visual control of all the beach area;
- telephones should be provided, in association with food services building or restroom change house building.

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2.4 BEACHES:

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Douglass, Robert W. Forest Recreation. Toronto: Pergamon Press Inc., 1975.

Fogg, George E. Park Planning Guidelines. n.p.: National Society for Park Resources, 1975.

3. PLAYGROUNDS

objective:

to provide a child with a safe and exciting play area, that caters to a variety of interest and skill levels.

3.0 CHILDREN'S PLAYGROUNDS:

- minimum area recommended for a playground is 72 m^2 ; there is no maximum size limit;
- playgrounds for very young children (ages 1-6 years) should be within 100 m walking distance;
- playgrounds for older children (ages 6-17 years) should be within 300 m walking distance;
- locate the playground at least 30 m from the street, if possible;
- locate play equipment at least 61 m from any active sports or games area;
- recommended slope for a slide is 2:1 with a 1:1 slope in sections to increase users' speed;
- all swimming devices should have a 2.1 m use-area surrounding it, plus a 1.8 m no-encroachment zone at the front and back;
- slides should have a 1.5 m use-area surrounding it, plus a 2.1 m no-encroachment zone at the front and a 1.8 m no-use area on all sides;
- revolving equipment should have a 2.1 m use-area surrounding and a 1.8 m no-encroachment zone;
- stationary devices should have a 1.8 m use-area.

3.1 TYPES OF PLAY:

- there are four types of play that should be provided for: physical, social, creative and quiet play;
- physical control and skill is developed through practice and experimentation;
- a child should have the opportunity to climb, hang, slide, swing, balance, push, pull, or lift at some point with the play equipment provided;
- therefore, the aim should be for multi-purpose structures that offer the maximum potential for a variety of muscular activities, i.e. systems play structures with slides, swings, ropes etc.;
- also provide play aids for the development of social skills;
- provide an area where the imagination dictates;
- avoid abstract and ambiguous structures;
- provide areas for creative play that allow children to test ideas, exercise ingenuity and satisfy their curiosity;
- provide objects and elements that can be manipulated to create different arrangements; provide the child with necessary objects to be creative;
- provide as many materials as possible of the natural environment, such as loose earth, grass, sand, water and vegetation;
- also provide quiet areas where the child can sit or play alone;
- these areas should include seating areas (some in the shade), tables and intimate out-of-the-way spaces.

3.2 SITE CHARACTERISTICS:

- playgrounds should be located in areas to provide some sunny and sheltered areas as well as some shaded areas;
- should be easily accessible to an unsupervised child (few streets to cross, etc.);
- should have an easy gradient for walking or riding bicycles, but rolling terrain can be incorporated into the site as part of play equipment, buffers, etc.;

- the more active, intensively used part of the playground, should be surrounded by a low enclosure with extra planting and have only one entry/exit;
- make use of the surrounding environment for enhancement of play environment;
- provide shelter from the weather, on site, or close by (i.e. if sharing shelter with playing-field, shelter may be located between the two).

3.3 PRESCHOOL CHILDREN (1-6 years):

- locate playground within 100 m walking distance, out of general pedestrian traffic patterns, but still close to the areas of adult activity;
- design to comfortably accommodate "little people" with minimum supervision;
- recommended area, 72-250 m^2 for 20-30 children;
- should contain few moving parts;
- provide seating for supervising adults;
- consider fencing in the area, as an added supervision tactic.

3.4 ELEMENTARY SCHOOL CHILDREN (6-11 years):

- should be within 300 m walking distance;
- locate within sight of adults' activity areas, but away from picnic sites, due to noise level;
- locate fairly close to playing-fields, since children of this age enjoy field sports;
- design to accommodate active, inquisitive children who want to be challenged and need to succeed;
- recommended area is variable, 90-900 m^2 for 30-150 children;
- provide equipment with moving parts, since they are of major interest for this age group;
- keep different activities separate, for safety;
- provide some seating for adults, since some supervision still occurs.

3.5 TEENS AND YOUNG ADULTS:

- can be located further away than for other age groups;
- not so much a playground as a meeting place;
- keep separate from family activities' area;
- provide activities that will challenge and test their skills, such as a fitness trail;
- provide place to sit and talk or watch others.

3.6 LAYOUT AND COMPONENTS:

- playgrounds should be laid out in such a way as to encourage a flowing circulation system, and use movement but minimize clashes between activities (i.e. between quiet and active areas);
- there are 3 general playground layouts (see Fig. 3.1);
- through design and layout, provide a sense of enclosure for areas with play equipment;
- the play program should change with age and skill-level of children;
- provide equipment/activities that excite, stimulate, and challenge children, physically and mentally;
- there is a range of program development from standard metal play equipment with swings, slides and sandbox, to more interesting and challenging equipment such as wooden climbing structures, cargo-net climbers, ladders, pulleys, swings, and sand and water on site;
- more interesting equipment increases the chance of retaining the children's interest over longer periods of time;
- provide equipment that can be manipulated, such as water and/or earth;
- locate sand in well-drained sunny locations, so the area dries out quickly after getting wet;
- drinking water and sanitary facilities should be provided within a short walking distance of the playground;
- use steps and retaining walls as seating areas or part of play equipment;

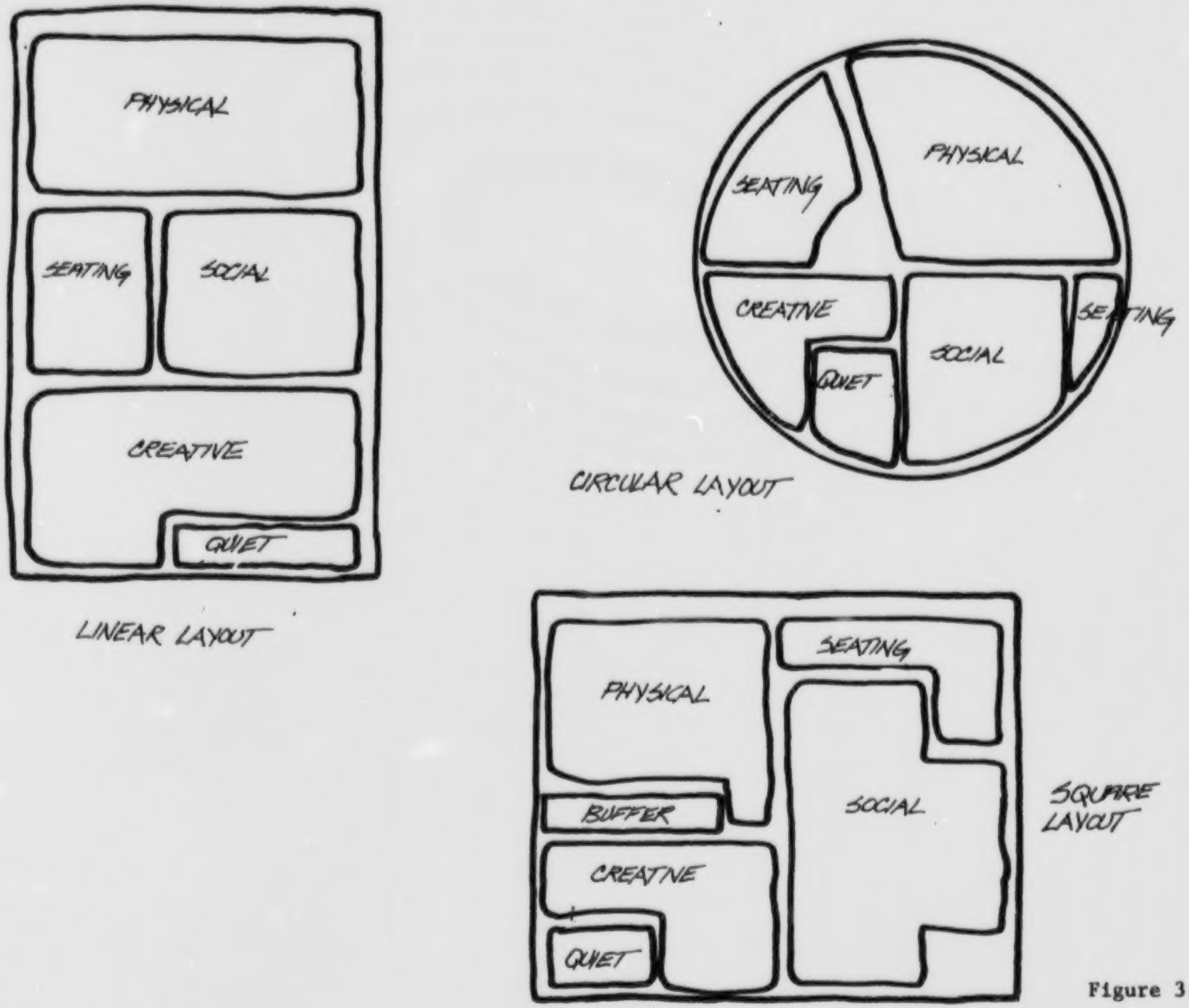
PHYSICAL
SEATING
SOCIAL
CREATIVE
QUIET
LINEAR LAYOUT
SEATING
PHYSICAL
CREATIVE
QUIET
SOCIAL
SEATING
CIRCULAR LAYOUT
PHYSICAL
SEATING
BUFFER
SOCIAL
CREATNE
QUIET
SQUARE LAYOUT

Figure 3.1 - Conceptual Playground Layouts

- trash receptacles should be available in all parts of the playground, especially the seating areas;
- if playground is to be used in the evening, provide sufficient vandal-proof non-institutional lighting;
- preserve as much of the existing terrain and other natural features as they are assets to a play environment;
- have separate areas for very young children and for older ones to avoid accidents;
- quiet and active areas should be separated by buffers, e.g. vegetation, berms, fences, etc.;
- always remember the difference in scale when designing for children;
- swings and slides should be located away from major circulation paths so as not to conflict with other uses;
- tall free-standing slides are dangerous; it is better to place slide into a berm so it becomes part of the hill and also a safer piece of equipment;
- avoid orienting the slide to the south and south-west, if made of metal, because the sun heats them up to a dangerous temperature;
- avoid sharp edges and butt joints on equipment;
- at landings of swings and slides where children jump off or into, place a soft dry material to soften the impact;
- on high climbing structures, provide walls or railings;
- if quiet areas are provided near the climbing structure, they should be underneath the equipment rather than on the sides, where children may fall on each other;
- to prevent young children from using a structure, raise the height of the first step so they cannot reach it;
- all hardware should be countersunk;
- layout of the climbing structure should form a circuit within itself, and every level of it should have optional ways of leaving it;
- very popular equipment should be placed in close proximity to each other and not at opposite ends of the playground;

- equipment should form natural walkways or runways;
- equipment designed for the handicapped should be placed outside the normal traffic flow or in a more protected area;
- wood is the recommended building material since it is "warm", and not as dangerous in the winter as metal;
- recommend the use of recycled materials for lower overall costs and because they can be more exciting than standard equipment;
- recommend varying the slopes, surfaces, textures, colours, for interest;
- always contain sand areas and make sure they are a minimum of 304 mm in depth;
- solid material, e.g. brick, stone, asphalt, should be placed around the edges of the sand area, as grass will not survive;
- provide storage areas for play equipment and maintenance equipment.

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U.S. Department of the Interior Bureau of Outdoor Recreation. Outdoor Recreation Space Standards. Washington D.C.: U.S. Government Printing Office, 1967.

4. PLAYING-FIELDS

objective:

to provide areas for active recreation, often in an organized situation, for older children and adults.

4.0 PLAYING-FIELDS:

- provide 1 hectare of playing-field area for every 2,000 people;
- recommended slope is 2%; 5% maximum slope;
- provide an area of at least 4.0 hectares, 8-20 hectares is preferred for fields;
- locate playing-fields within 1.6 km of dwelling unit, picnic ground, etc.;
- locate activities in such a way as to allow a number of different sports to share the same facility;
- 6 or 8-man football field: 73 m long, 36.6 m wide, plus 9.1 m at both end zones; (or whatever space is available);
- 12-man football field: 100 m long, 59 m wide, plus 22 m at both end zones; (Regulation CFL)
- goalpost 5.6 m wide, 6.0 m high, centered;

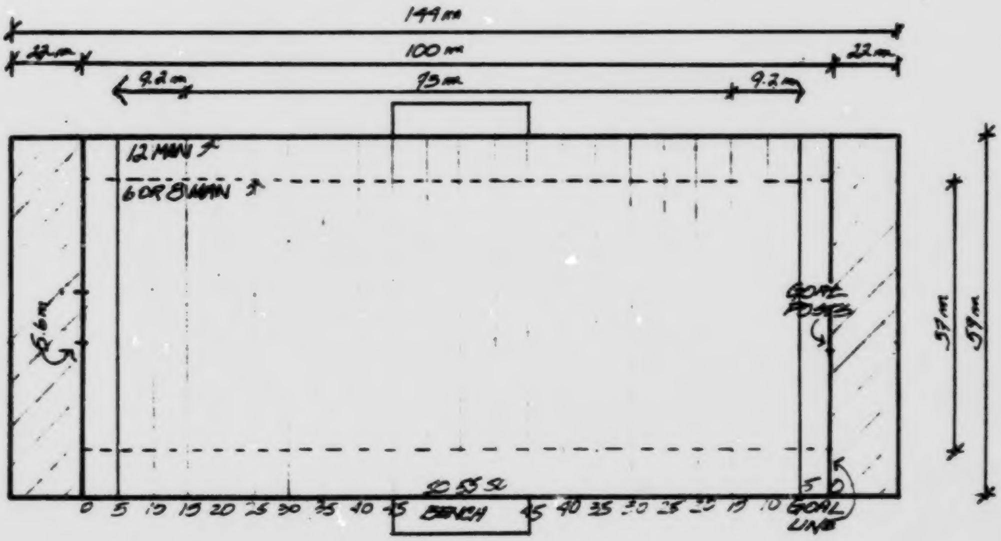
144m
22m
100m
22m
9.2m
73m
9.2m
12 MAN
6 OR 8 MAN
5.6m
GOAL POSTS
37m
59m
50 55 50
5 0
0 5 10 15 20 25 30 35 40 45 BENCH 45 40 35 30 25 20 15 10 GOAL LINE

Figure 4.1 - Football Field

- soccer field: 91.4 m long, 46.0 m wide;
- the goalposts are 2.4 m high and 7.3 m apart;
- the goal is 18.3 m wide, the goal zone is 33 m wide;

- the radius from the goal to the outer edge of the goal zone is 16.5 m;

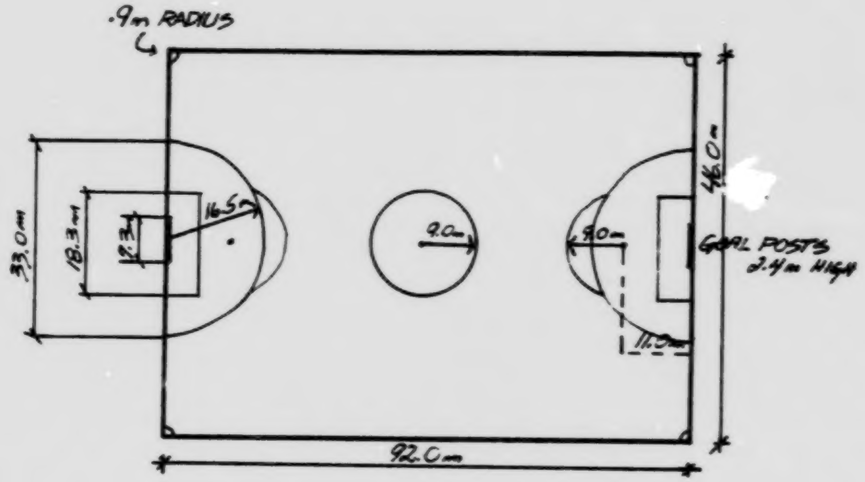
.9m RADIUS
46.0m
33.0m
18.3m
7.3m
16.5m
9.0m
9.0m
GOAL POSTS
2.4m HIGH
11.0m
92.0m

Figure 4.2 - Soccer Field

- softball diamonds vary in size: recommended size for senior softball is 18.3 m x 18.3 m (See 5. Softball Diamonds).

4.1 GENERAL:

- areas within the playing-fields can be designed for various age levels, abilities and interests of the users;
- best area to locate a playing-field is in open fields or poor timber stands;
- playing-fields should be well-drained so that puddling does not occur;
- vegetational buffering should be provided when the playing-fields are adjacent to other facilities such as picnic areas, beaches, campgrounds, etc. to lower noise levels and visibility of the field and its users.

4.2 SELECTED REFERENCES

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Saskatchewan Department of Tourism & Renewable Resources. *Recreation Facility Standards Manual*. n.p.: Department of Tourism and Renewable Resources, 1977.

5. SOFTBALL DIAMONDS

objective:

to provide a suitable area to play the game of softball or baseball.

5.0 SOFTBALL DIAMONDS:

- minimum recommended slope is 1%;
- recommended slope is 2%;
- the diamond should be oriented to the south-west or north-east, to ensure that an imaginary line from home plate to second base is at right angles to the rays of the sun during the time of greatest use at mid-season;
- 76 m x 98 m is recommended for the standard softball diamond;
- recommend dirt or grass or combination of these surfaces for the field.

5.1 GENERAL:

- diamond should be centre crowned to allow drainage of excess water off the site;
- the proximity of main utility lines may or may not be important in site selection (this depends on the degree of sophistication required);
- the diamond should be readily accessible either from a parking lot or a trail system;
- recommend combining a baseball diamond with other sports fields (football, soccer) to provide maximum variety for users, as well as to share in the construction and maintenance costs.

5.2 COMPONENTS:

- it is necessary to provide some sort of backstop to catch the baseballs; (behind batter)
- provide lighting if the diamond is to be used in the evening;
- provide base markers for home plate, for first, second and third bases, and for the pitcher's mound;
- if the pitcher's mound is built up, it should be to a height of 0.1 m - 0.3 m;
- provide ample parking at or near the diamond (if football and soccer fields are also provided, the area for parking must be increased);
- provide washroom facilities (within a comfortable walking distance), seating for spectators, drinking water, trash receptacles and, possibly, a telephone and first aid station;
- baseball/softball diamonds are usually associated with general playing-fields as well as picnic grounds; advisable to locate the components listed above between all these activity areas rather than duplicate services.

5.3 DIMENSIONS:

	Softball	Baseball
length of baseline	15.2 m women, 18.3 m men	27.4 m
pitching distance	10.6 m–14.0 m	18.4 m
batter's box	0.9 m x 1.6 m, 0.9 m x 2.1 m	1.2 m x 1.8 m
base size	4.5 m x 4.5 m x 1 m	4.5 m x 4.5 m x 1 m
coach's box	3 m x 4.5 m	3 m x 6 m
home plate–backstop	7.6 m	18.3 m
left field distance	60 m	76.2 m–97.5 m
centre field distance	60 m	76.2 m–121.9 m
right field distance	60 m	76.2 m–97.5 m

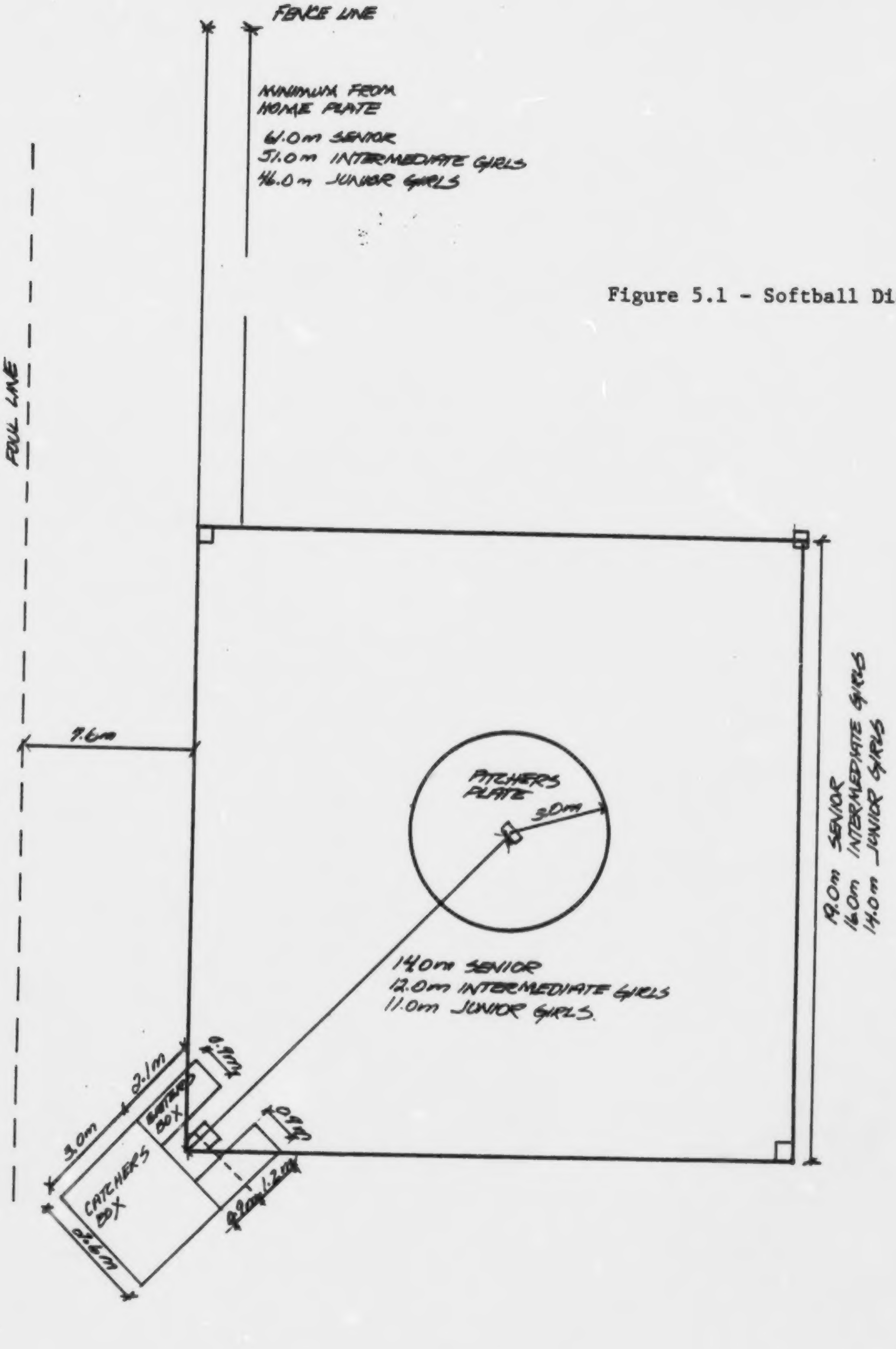
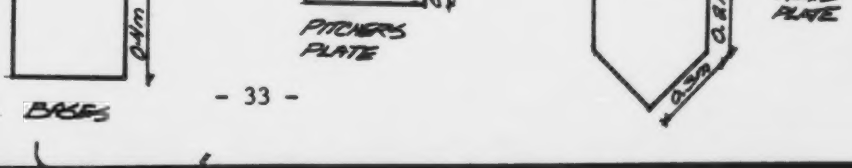

FENCE LINE
MINIMUM FROM HOME PLATE
61.0m SENIOR
51.0m INTERMEDIATE GIRLS
46.0m JUNIOR GIRLS
FOUL LINE
9.6m
PITCHERS PLATE
3.0m
14.0m SENIOR
12.0m INTERMEDIATE GIRLS
11.0m JUNIOR GIRLS.
19.0m SENIOR
16.0m INTERMEDIATE GIRLS
14.0m JUNIOR GIRLS
0.9m
2.1m
BATTERS BOX
3.0m
CATCHERS BOX
2.6m
0.9m
0.9m
1.2m

Figure 5.1 - Softball Diamonds


0.4m
0.4m
BASES
0.6m
0.15m
PITCHERS PLATE
0.4m
0.2m
0.3m
HOME PLATE

5.4 SELECTED REFERENCES

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DeChiara, Joseph and Callender, John Hancock. Time-Saver Standards for Building Types. New York: McGraw-Hill Book Co., 1973.

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6. GOLF-COURSES

objective:

to provide a specialized area with the necessary layout and facilities to play golf.

6.0 GOLF-COURSES

- 9-hole golf-course, 20 hectares minimum area;
- 9-hole golf-course, 28-33 hectares recommended area;
- 18-hole golf-course, 44.5 hectares minimum area;
- 18-hole golf-course, 65-72 hectares recommended area;
- ideal 9-hole golf-course is 2,743-3,108 m in length;
- ideal 18-hole golf-course is 5,486-6,216 m in length.

6.1 GENERAL:

- there are a variety of different golf-courses: 18-hole championship, 18-hole regulation, 9-hole, par-3 and miniature;
- all follow the same basic design principles;
- each requires a rectangular site, oriented in a north-south direction, with minor topographical changes;
- there is no set layout for the optimum course; depends on amount of land available;
- each course should allow a player to use all or most of the golf-clubs possessed;
- avoid rugged sites; instead choose gently rolling sites;
- a site that is too hilly, is tiring to the players, necessitates too many blind shots, and is more costly to keep well turfed;
- the ideal course is situated on sandy loam soils; although most other soil types are acceptable the cost to maintain the turf increases;
- some topographic features such as rolling terrain, creeks, valleys, woodlands, ravines, ponds are considered assets to a course.

6.2 PAR:

- par is the score standard for each hole and should total 35, 36 or 37 for the whole course;
- a 9-hole golf-course should include two par-3 holes, two par-5 holes, and five par-4 holes;
- the ideal par sequence for 9-holes is 4-5-4-3-4-5-4-3-4=36;
- the length of a par-3 shot should be 118-183 m;
- the length of a par-4 shot should be 320-429 m;
- the length of a par-5 shot should be 430-502 m;
- par-3 holes should be arranged so that the first of the two is not earlier in the round than the 3rd hole and the other par-3 hole is not later than the 8th hole in a 9-hole golf-course;
- par-3 holes should not be located consecutively.

6.3 TEES AND GREENS:

- the distance from the green to the next tee should be 18-30 m, with a maximum distance of 69 m;
- tees should not be closer than 18.0 m to a green, because of the danger of being hit by a golf ball;
- the first tee, the 9th green, the 10th tee and the 18th hole should be located immediately adjacent to the clubhouse;
- to minimize wear and tear on the tee-off area, change the position of the tee;
- irregular-shaped greens allow for a greater variety of pin placements;
- when golf-carts are used, provide areas for their parking close to the green and site them in such a way to spread out the walking pattern;
- in most cases, provide a hard surface walk/drive strip to carry the load;
- minimum width of pavement 1.8 m; 2.4 m is recommended;
- area for greens; recommended 465-743 m ;
- the shape of the green varies depending on the strategy of the design, the location and size of the traps, and the length of the shot required to play it;
- where the slope of the green is from front to back, the slope should not be greater than 5%, unless there is a break in the slope by a depression;
- slopes on the approach of a plateau green can be as high as 20%.

6.4 THE FAIRWAY:

- can be wide, narrow, cross or border natural, or artificial water bodies, steep or level, uphill or downhill, tree-bordered or open, straight or a dog-leg bordered by rough or manicured vegetation;
- the dimension and shape of the fairway is intrinsically tied to the strategy of a particular hole;
- should be designed to offer the player alternative choices as to direction, length and placement of golf stroke;

- minimum width 55 m;
- 69-110 m from the tee to fairway, could be 37 m wide;
- 110-164 m from the tee to fairway, could be 46 m wide;
- can become narrower to the next landing if the hole is long, that is from 302-402 m.

6.5 **HAZARDS:**

- should make use of natural features whenever possible, e.g. bodies of water, existing sand areas, rough, ridges, etc.;
- sand-traps are artificial devices made to penalize the golfer for a poor stroke;
- they tend to be difficult to maintain with modern equipment because they present specialized edges difficult for large machinery to master;
- slopes of the trap, in front and on the sides can be 30%-40%;
- at entrance to the traps, slopes should not be greater than 25% so the golfers' backswing can be taken with a full clean stroke.

6.6 **LAYOUT:**

- as far as possible, no holes should be laid out in an east-west direction since the highest volume of play on any course is in the afternoon and it is hard to follow the ball when you are looking directly into the sun;
- if it is impossible to avoid this orientation, locate it within the first two or three holes of the course;
- south-west orientation of holes is especially bad;
- the first four holes of any course should be relatively easy, i.e. a par-4 no more than 347-365 m in length;
- the first hole should be free of hazards or heavy rough and should have no features that will hold a player back;
- the holes should become progressively more difficult to play as the round proceeds;
- whenever possible, the greens should be visible and the location of the sand-trap and other hazards obviously apparent from the approach area;

6.7 CIRCULATION:

- a golfer should be able to proceed directly from the parking lot to the locker room, clubhouse, pro shop and restaurant area;
- the practice range should be located adjacent to the clubhouse;
- if other recreational facilities are provided they should be separated from the golfers' area
- on the course itself, routes should be planned for pedestrians and golf-carts;
- allow each cart an area of 1.2 m x 2.4 m for parking near the tee;
- keep parking and walkways at least 9.1 m from playing area;
- use non-slip, all weather materials, i.e. gravel, asphalt, etc.

6.8 SELECTED REFERENCES

Carpenter, Jot. D. *The Handbook of Landscape Architectural Construction*. New York: The Landscape Architecture Foundation Inc., 1976.

DeChiara, Joseph and Callender, John Hancock. *Time-Saver Standards for Building Types*. New York: McGraw-Hill Book Co., 1973.

7. TENNIS COURTS

objective:

to provide an adequate playing area and related facilities to play the game of tennis.

7.0 TENNIS COURTS:

- tennis courts should be oriented in a north-south direction;
- playing surface for a singles' tennis court: 23.8 m long, 8.2 m wide;
- playing surface for a doubles' tennis court: 23.8 m long, 11 m wide;
- there should be a minimum of 3.6 m allowed between courts, when they are constructed in series of two or more;
- the recommended slope for tennis courts is 3%-5%;
- provide a minimum of 5 parking stalls per court, 4 stalls for staff and visitors, and an overflow area for peak periods (i.e. during a tournament, etc.);
- according to the Manitoba Tennis Association, provide 1 outdoor court for every 2,800 users.

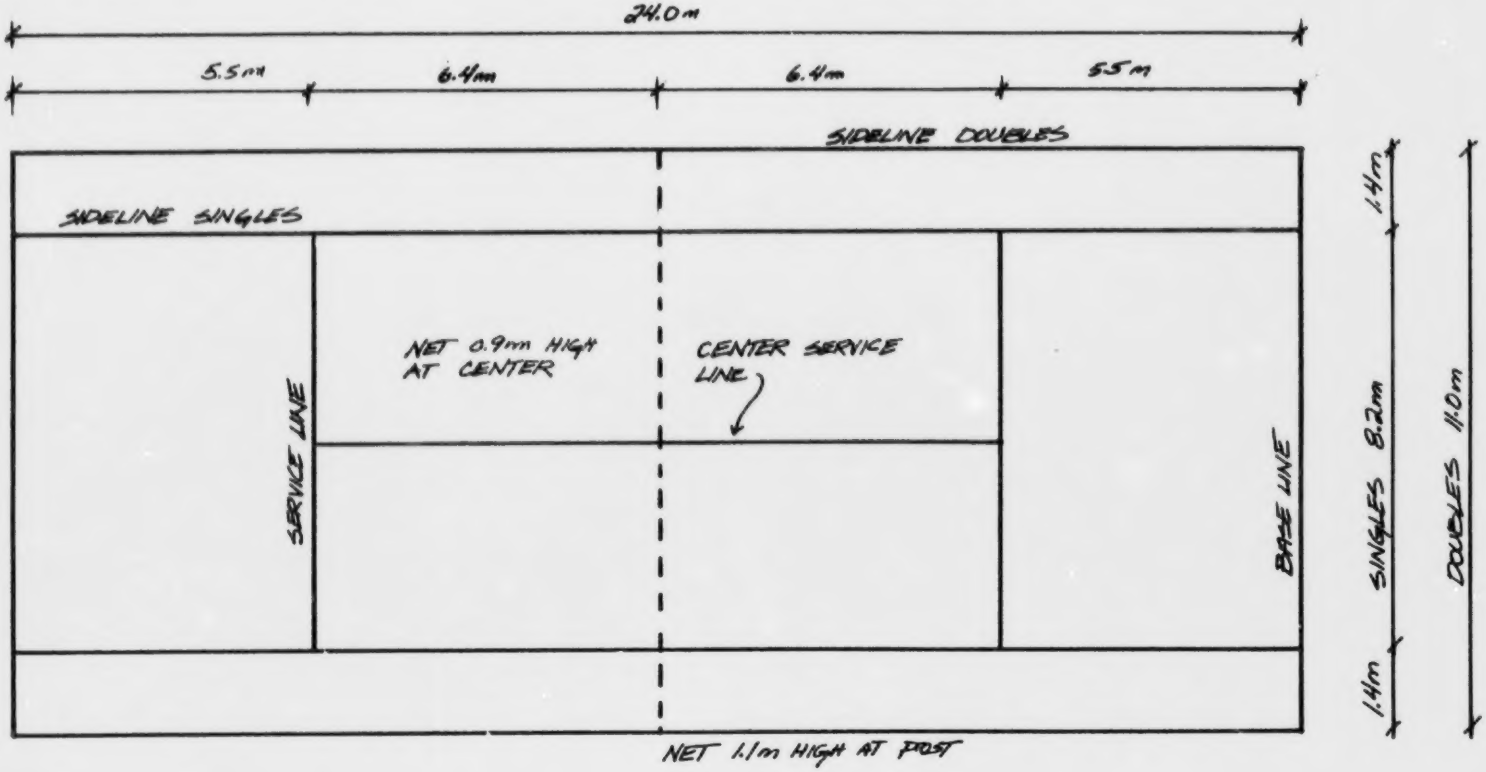
24.0m
5.5m
6.4m
6.4m
5.5m
SIDELINE DOUBLES
SIDELINE SINGLES
NET 0.9m HIGH AT CENTER
CENTER SERVICE LINE
SERVICE LINE
BASE LINE
1.4m
SINGLES 8.2m
1.4m
DOUBLES 11.0m
NET 1.1m HIGH AT POST

Figure 7.1 - Tennis Court

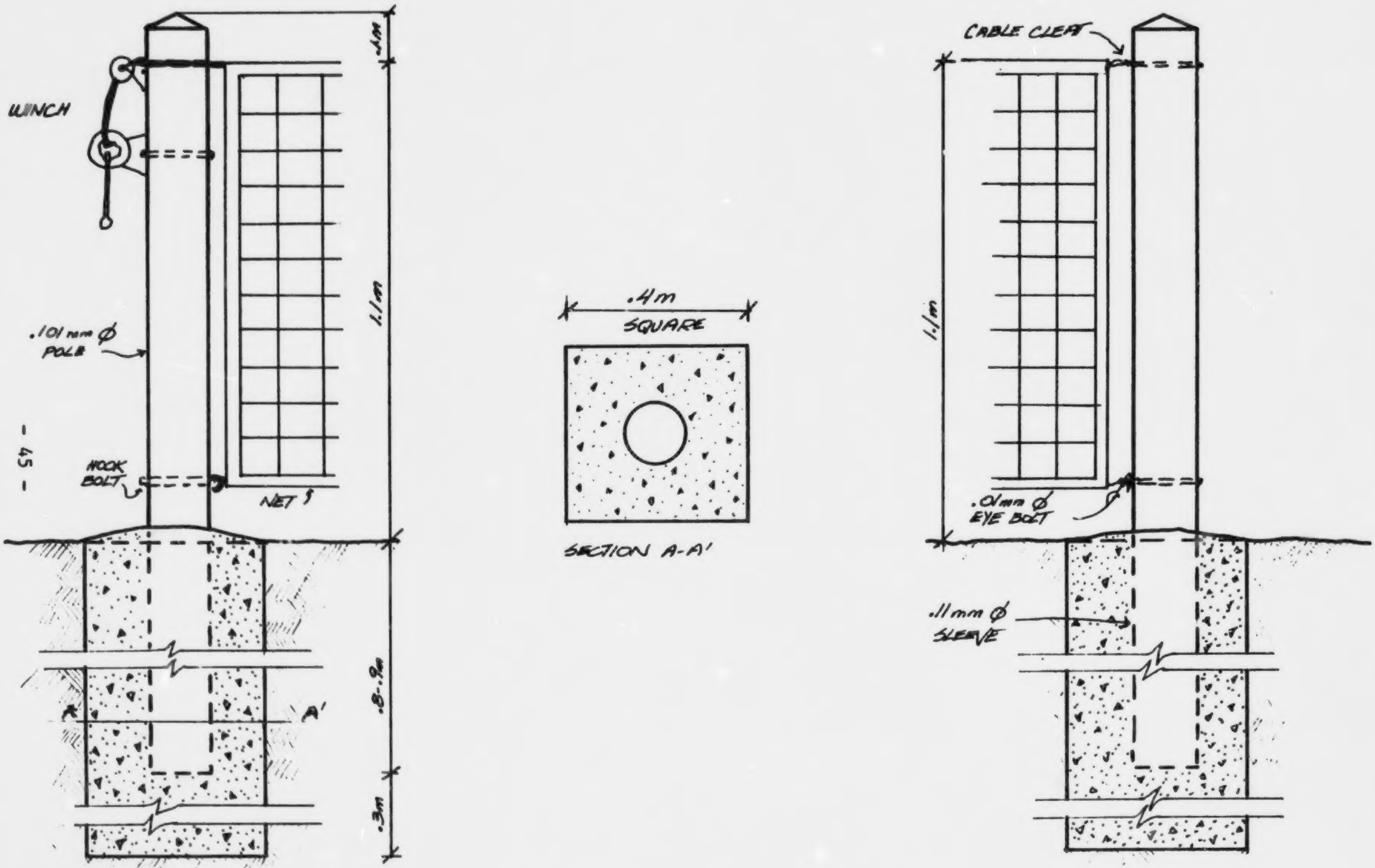
WINCH
.101 mm Ø POLE
HOOK BOLT
NET ⚲
.4m
1.1m
.8-.9m
.3m
A
A'
.4m
SQUARE
SECTION A-A'
CABLE CLEAT
1.1m
.01mm Ø EYE BOLT
.11mm Ø SLEEVE

Figure 7.2 - Tennis Net and Post Details

7.1 SURFACE AND DRAINAGE:

- each tennis court should be a true plane providing drainage from side to side or end to end, but should never drain to or from the net or centre line because this in effect raises or lowers the net;
- draining on a porous surface from end to end; tends to keep the lower court wetter after a rain;
- the player on the higher side, has a slightly lower net to clear than the player on the lower side;
- all types of known playing surfaces are adequate;
- important to determine if a hard or soft playing surface is required;
- hard playing-surfaces include concrete and asphalt;
- they tend to be tiring to play on and hard on the legs and feet due to their lack of resiliency;
- hard playing-surfaces require little maintenance, weather well and are not susceptible to mechanical damage or damage through use;
- soft surfaces include clay, grass or synthetic carpets;
- these surfaces are less tiring to play on due to their resiliency, but are easily damaged and must be continually maintained;
- medium surfaces are neither hard nor soft, and include asphalt-bound systems and certain plastic or rubber compounds;
- these surfaces blend the characteristics of hard and soft surfaces;
- they generally are not too tiring to play on, nor too susceptible to damage, and do not require much maintenance;
- their biggest disadvantage is their high installation cost.

7.2 SITE CHARACTERISITICS:

- tennis courts have to have a smooth flat surface, therefore, the ideal terrain for a tennis court would be flat, but a more rolling topography can be regraded to provide a sufficiently flat surface;

- soils should be stable and densely compacted to form a good base;
- the area must be well drained, or graded to provide good drainage;
- vegetation can serve as windbreaks and buffers, but the species chosen should not drop excessive litter etc., therefore, avoid American elm, maples and other problem species;
- provision of a vegetative canopy cools the tennis courts, but heavy undergrowth in wet areas lends itself to insect reproduction;
- tennis courts should be located so that they are sheltered from prevailing winds;
- avoid light-coloured backgrounds such as white buildings, and moving objects, as they provide too much of a distraction.

7.3 SIZE AND LAYOUT:

- it is recommended that extra room be provided at the back and the sides of the court for general circulation or court furniture;
- recommended size of championship courts is 40.8 m long and 20.0 m wide;
- for general tournament play, recommend a court, 26.6 m long, 18.3 m wide;
- the minimum recommended size for a private court is 33 m long, 15.9 m wide;
- if space is very limited, could provide a singles' court playing-surface only (23.8 m long x 8.2 m wide);
- it is less expensive to construct tennis courts side by side, but if the landscape does not allow for two or more courts side by side then they can be placed end to end.

7.4 LIGHTING:

- support poles for double cable system (lights on two side-by-side courts) should be less than 9.1 m high;

- the double cables are limited to 45°-angled luminares and at least 1500 watt bulbs; so readings of 25-30 foot-candles are obtained over entire playing area;
- usually have 12 luminares per court, equally spaced along the sides, directing light down at a 45°-angle onto the court;
- avoid overhead lights so the players do not have to look directly into lights while serving;
- could also locate floodlights on poles behind tennis courts to avoid glare;
- recommend lighting level of 10-20 foot-candles for local recreational play;
- recommend lighting level of 30-35 foot-candles for tournament play;
- colour tone of lights is important;
- warm tones preferred to cold bluish tones;
- avoid light spill outside of court areas.

7.5 SELECTED REFERENCES:

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Carpenter, Jot. D. ed. The Handbook of Landscape Architectural Construction. New York: The Landscape Architecture Foundation Inc., 1976.

Duncan, S. Blackwell. How to Build Your Own Tennis Court. n.p.: TAB Books, 1979.

8. HORSESHOE PITCHES

objective:

to provide an area of suitable size and character for the pitching of horseshoes.

8.0 HORSESHOE PITCHES:

- recommend that horseshoe pitches be oriented in a north-south direction;
- the pitch is 3.0 m wide, and 15.2 m long for men or 12.1 m for women and children;
- the slope of the pitch should be approximately 3%;
- the pitch should be crowned so that drainage is to the side;
- the iron stake is to be set into a 2 m x 2 m sand pit.

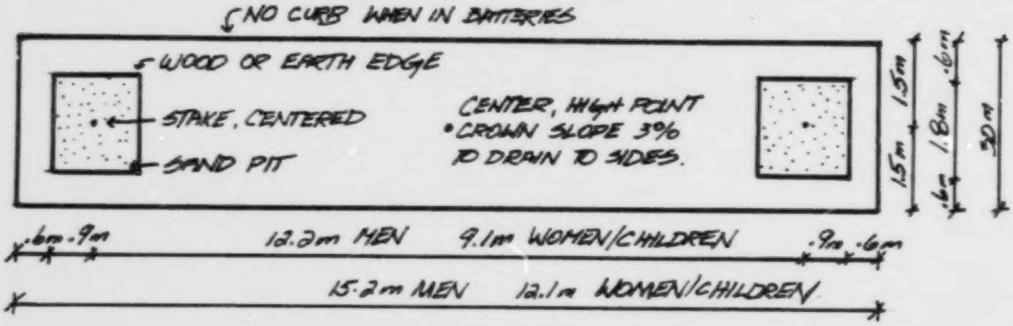
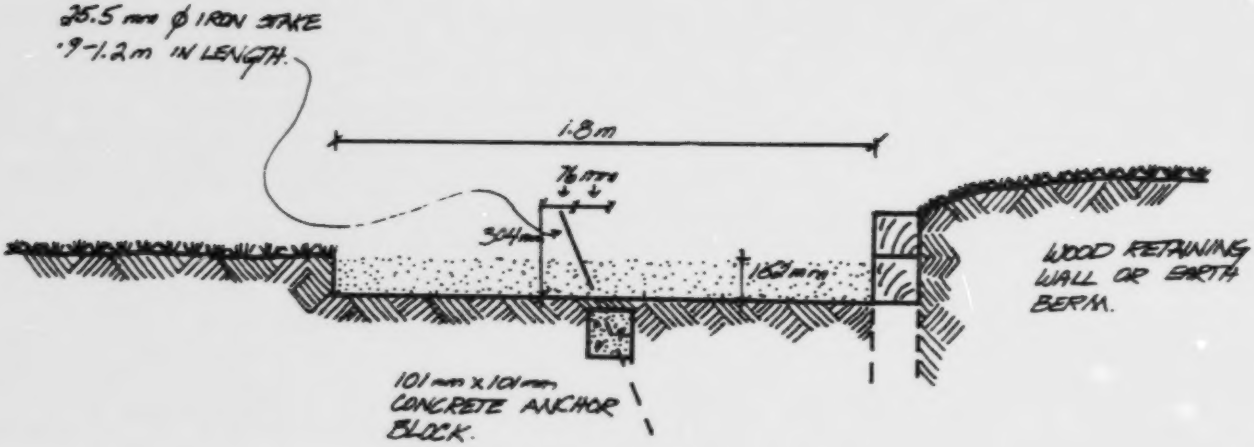

NO CURB WHEN IN BATTERIES
WOOD OR EARTH EDGE
STAKE, CENTERED
SAND PIT
CENTER, HIGH POINT
CROWN SLOPE 3%
TO DRAIN TO SIDES.
1.5m
1.5m
.6m
1.8m
.6m
3.0m
.6m .9m
12.2m MEN
9.1m WOMEN/CHILDREN
.9m .6m
15.2m MEN
12.1m WOMEN/CHILDREN

Figure Plan


25.5 mm ⌀ IRON STAKE
.9-1.2m IN LENGTH.
1.8m
76 mm
304mm
162mm
101 mm x 101 mm
CONCRETE ANCHOR
BLOCK.
WOOD RETAINING
WALL OR EARTH
BERM.

Section

Figure 8.1 - Horseshoe Pitch

8.1 GENERAL:

- locate the pitch in association with other day-use activities;
- the pitch surface can be sod, dirt, sand or a variety of hard surfaces such as asphalt or concrete;
- the sand pit should have a back wall of either grassed berms, or a low (152 m-203 mm) retaining wall to "catch" overthrown horseshoes;
- the sand pit should be 152.4 mm deep;
- the iron stake should be 25.4 mm in diameter and made of iron or a similar material;
- the stake should be 0.9-1.2 m in length;
- the stake should be anchored in a concrete block (101 mm x 101 mm) at a 60°-70° angle;
- the anchor should be placed 203 mm below the ground surface.

8.2 COMPONENTS:

- provide benches, trash receptacles, washrooms within a short walking distance, and drinking water;
- if the users have to drive to reach the area where the pitch is located, must also provide sufficient parking space;
- if the users will be walking to the site, provide a well-defined trail accessible to all users .

8.3 SELECTED REFERENCES

Carpenter, Jot. D. ed. The Handbook of Landscape Architectural Construction. New York: The Landscape Architecture Foundation Inc., 1976.

DeChiara, Joseph and Callender, John Hancock. Time-Saver Standards For Building Types. New York: McGraw-Hill Book Co., 1973.

9. MARINAS

objective:

to provide access points to recreational waters, safe storage for boats, and other water/land oriented facilities.

9.0 MARINAS:

- common types of craft: keel sailboats, dinghy sailboats, inboard and outboard motorboats for recreation or fishing;
- lengths of these craft vary from 3.6-7.3 m for small motorboats to 6.7-7.3 m for fishermen's boats, up to 9.1-27.4 m for large motorboats and sailboats;
- the site chosen for the marina must have good water and land access;
- the size of the marina is dependent upon economic conditions, anticipated use and demand, etc.;
- a small marina may contain 30-50 berths;
- usually require 100 boats/berths to be viable;
- important that there is sufficient area to expand if required;
- the entry to the harbour must be sited so that it reduces wave action within the marina;
- the location of the entrance should take into consideration the predominant wind direction, i.e. if the predominant winds are from the north or north-west, a breakwater should be placed to the north and the entry should be located to the south or south-east, or on the lee side;
- for small harbours, the recommended entrance width is 91.4 m;
- for medium-sized harbours, the recommended entrance width is 122-152 m;
- for large harbours, the recommended entrance width is 152-244 m;
- minimum bottom width of the channel is 22.9 m;
- for a marina containing 300 or more boats, a fully serviced "centre" should be provided;
- parking space should be provided, at approximately 1 1/2 x 2 1/2 stalls per berth;
- the parking area should be located a short walking distance from all berths (182 m maximum);
- provide 1 or 2 launching ramps per marina.

9.1 GENERAL:

- the size of the marina is dependent on demand, the carrying capacity of the surrounding environment, the economy and other factors;
- a basic marina would consist of safe berthing area, provided through breakwaters, bulkheads, groynes or natural harbour, navigational aids, moorage, a service station, washrooms, first aid and administrative services and parking space;
- if a more self-sufficient marina development is required, then provision for the following facilities should be made: swimming, water skiing, dry dock, food services, supply store, potable water and showers, electricity, lockers and storage, rentals, repairs, and overnight accommodation;

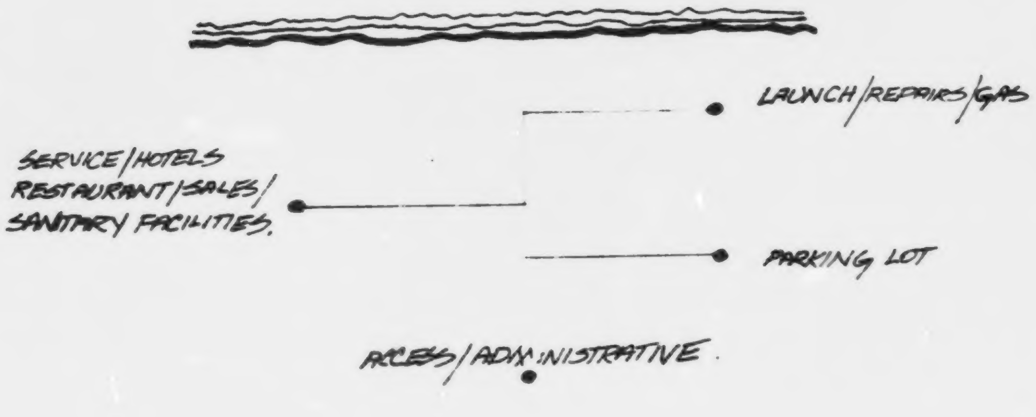

LAUNCH/REPAIRS/GAS
SERVICE/HOTELS
RESTAURANT/SALES/
SANITARY FACILITIES.
PARKING LOT
ACCESS/ADMINISTRATIVE.

Figure 9.1 - Schematic Circulation Layout

- recommend locating a marina in areas where it will be sheltered from the prevailing winds, will avoid beam-on wave action in deep water, with little or no sedimentation or erosion;

- avoid locating marinas near deltaic formations, near beaches or swimming areas, or along exposed shorelines;
- locate in areas with sufficient water depth to allow safe passage of the craft;
- in Manitoba, recommended depth is: for motorboats 0.9 m minimum at low water, for sailboats 1.83 mminimum at low water due to the keel.

9.2 ACCESS AND PARKING:

- vehicular access should be an all-weather road, a minimum of 5 m one-way or 6.5-7 m two-way;
- access to the water (launching ramp) should be located in association with the parking lot.

9.3 FACILITIES:

- in locations that freeze over during the winter, consider providing dry docks for storage;
- must provide a potable water source on site;
- provide fire protection;
- provide telephones (in conjunction with administrative or retail offices);
- provide on-site washrooms (1 fixture per 150 males, 1 fixture per 150 females, more if food services are provided);
- washrooms should be no more than 195 m away from the furthest boat/berth;
- provide 1 boat/sanitary dump station per marina, locate at or near the service dock;
- fuel supply should be easily accessible to boat traffic;
- storage of fuel should be underground and accessible to service vehicles;
- provide at least 0.5 m distance on both sides of the boat, over and above boat width per slip (for movement);
- there are a variety of docking arrangements; recommend main dock with finger docks;
- fixed mooring, constructed of steel, concrete, timber or a combination of these;

- floating moorings (non-permanent) can be constructed on oil drums, of steel piping, concrete, wood, industrial strength plastic, etc.;
- main dock providing access to boats should be a minimum of 2.4 m wide;
- finger docks (providing access to individual boats) may be a minimum width of 0.6 m;

Table 9.1 - General Dimensions for Docking

Length of Boat	Minimum Width of Slip	Width of Finger Dock	Length of Finger Dock			Length of Slips	Minimum Distance between Slips
			1st	2nd	3rd		
4.2m	2.6m	0.6m	3.6m			5.1m	4.2m
4.2- 4.8m	2.9m	0.6m	3.6m			5.7m	4.8m
4.8- 5.4m	3.1m	0.6m	4.2m			6.4m	5.4m
5.4- 6.0m	3.3m	0.6m	2.4m	2.4m		7.0m	6.0m
6.0- 6.7m	3.5m	0.6m	3.0m	2.4m		7.6m	6.7m
6.7- 7.6m	3.9m	0.6m	3.0m	2.4m		8.5m	7.6m
7.6- 9.1m	4.3m	0.6m	3.0m	3.0m		10.0m	9.1m
9.1-10.6m	4.7m	0.6m	3.6m	3.0m		11.5m	10.6m
10.6-12.1m	5.1m	0.6m	3.6m	3.6m		13.1m	12.1m
12.1-13.7m	5.4m	0.6m	4.2m	3.6m		14.6m	13.7m
13.7-15.2m	5.7m	0.6m	2.7m	2.7m	3.0m	16.1m	15.2m
15.2-18.2m	6.4m	0.6m	3.3m	3.3m	3.6m	19.2m	18.2m
18.2-21.3m	7.0m	1.2m	3.3m	3.3m	3.6m	22.2m	21.3m
21.3-24.3m	7.5m	1.2m	3.3m	3.3m	3.6m	25.2	24.3m

- the size of the boat influences the size of the slip;
- finger piers, when not required to be full length, are usually 2/3 of slip length;
- the slip should be 0.92 m longer than the expected boat length;
- recommend separating sailboats and motorboat docking;

- desirable to have a large grassed area along the shoreline with some type of anchoring system so users can pull up and secure their boats during the day and for use in launching car-top boats (applies mainly to sailboats);
- provide sufficient variety in slip sizes to allow for all boat types expected at any given marina.

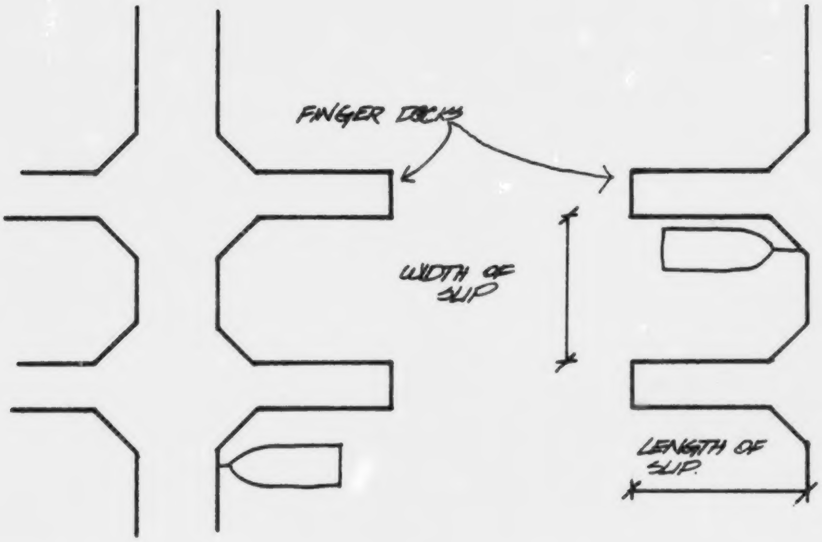

FINGER DOCKS
WIDTH OF SLIP
LENGTH OF SLIP

Figure 9.2 - Typical Docking Arrangement

9.4 SELECTED REFERENCES

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10. BOAT LAUNCH RAMPS

objective:

to provide the public with points of access to launch their boats into a body of water for recreational purposes.

10.0 BOAT LAUNCHING RAMPS:

- access to the boat-launching ramp should be located so that it is one of the first areas reached when entering a recreation area;
- one-way access road, minimum of 4.5-6 m wide;
- two-way access road, minimum of 6-7 m wide;
- recommended inner turning radius for turnaround, 6.1-8.7 m, maximum 12 m;
- recommended outer turning radius 12.2-12.8 m for turnaround, maximum 21.0 m;
- maximum grade of the ramp above waterline 10%;
- maximum grade of the ramp below waterline 13%-15%;
- minimum length of ramp under low waterline is 4.2 m, (with low water 0.6 m deep);
- minimum length of ramp above high water is at least the length of a car and trailer unit, 12.2 m (this allows the car and 3/4 of the trailer to remain on dry land);
- total ramp length, 16.4 m minimum;
- provide a minimum of 1 dock for every 2 lanes of launching;
- the ramp should be sheltered from prevailing winds, have little sedimentation and erosion;
- provide a parking lot for 10-50 cars and trailer units for each lane of launching;
- provide a minimum of 10% of the parking spaces for cars only;
- pull-through parking stalls recommended;
- dimensions of pull-through stall are 21.3 m long x 3 m wide minimum, on a 45° angle for easy maneuverability;
- provide washrooms no further than 91.4 m from the launching area;
- trash receptacles are a must.

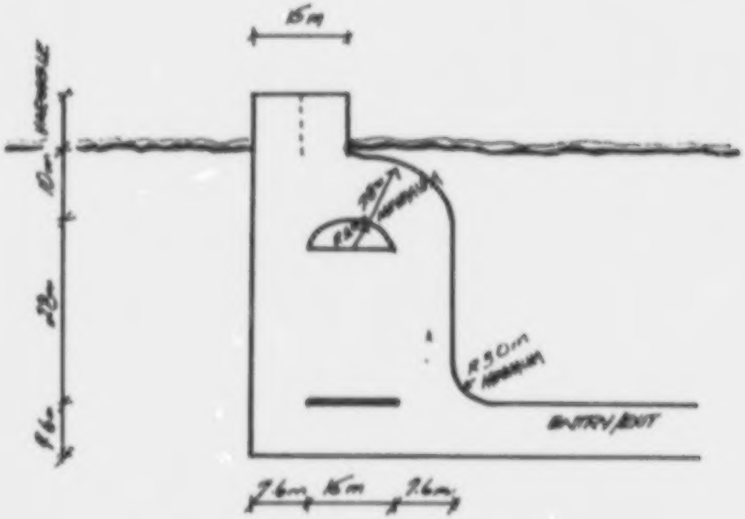
15m
10m
28m
7.6m
R50m MINIMUM
ENTRY/EXIT
7.6m
15m
7.6m

Figure 10.1 - Recommended Boat Launching Layout

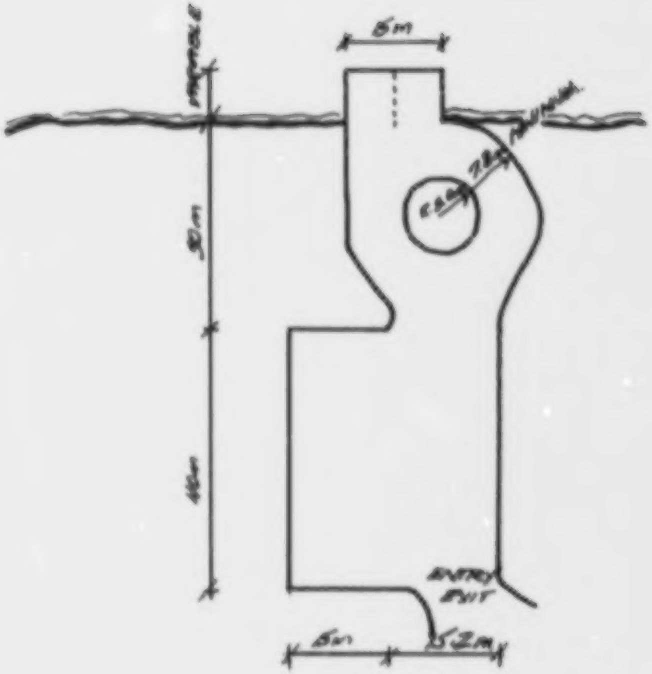
5m
30m
40m
ENTRY EXIT
5m
12m

Figure 10.2 - Alternate Boat Launching Layout

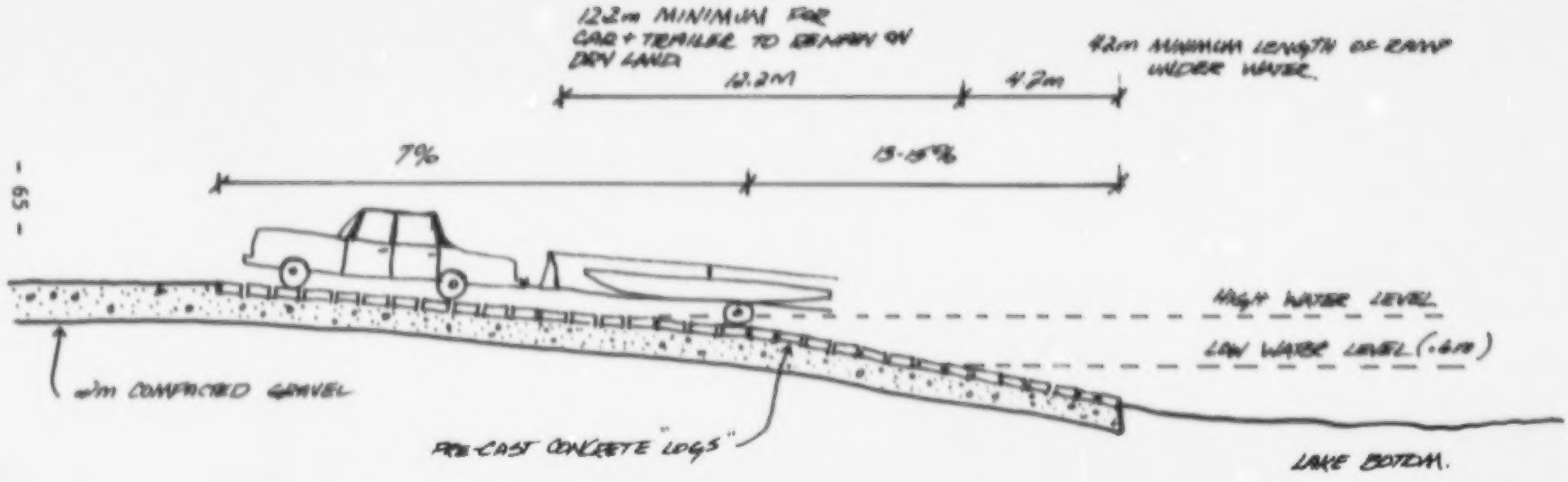
12.2m MINIMUM FOR
CAR + TRAILER TO REMAIN ON
DRY LAND
12.2M
4.2m
4.2m MINIMUM LENGTH OF RAMP
UNDER WATER
7%
13-15%
HIGH WATER LEVEL
LOW WATER LEVEL (.6m)
.3m COMPACTED GRAVEL
PRE-CAST CONCRETE "LOGS"
LAKE BOTTOM.

Figure 10.3 - Boat Launching Ramp Profile

10.1 GENERAL:

- if there is unlimited access to the water, there exists the danger of indiscriminate boat launching, which can destroy the vegetative cover, break down the banks, and cause widespread sanitation and ecological problems; therefore, the need for a defined boat launch site is apparent.

10.2 LOCATION:

- boat launching ramps should be built along bodies of water that have recreational boating value that can meet public demand;
- they can be used as a site-protection technique, or as a management aid;
- the location of the ramp entails study of the shoreline, geomorphology and microclimate of the area;
- a good location should have sufficient depth for boats and have a suitable backland for parking and other facilities;
- avoid locating the ramp near deltaic formations because they generally are too shallow; or along an exposed, uniform shoreline because they are too unprotected; or upcurrent from swimming areas due to potential pollution and safety problems;
- its location, design and construction should provide protection for boats in bad weather.

10.3 COMPONENTS:

- the boat launching area should consist of an access road, turnaround, ramp, docks, and parking lot at minimum for facilities;
- also consider the provision of washrooms, waste receptacles, picnic areas and campgrounds;
- these supplemental facilities are often necessary to improve the comfort and safety of the user.

10.4 ACCESS ROAD AND TURNAROUND:

- these components should be constructed of all-weather materials such as crushed gravel, concrete, or asphalt;

- the access road can be one-way or two-way, but the turnaround should be one-way only, to avoid confusion;
- turnaround should be sufficiently large in diameter to permit the car and trailer to maneuver into position for backing down the ramp.

10.5 THE RAMP:

- is used to back the boat trailer down into the water so that the boat can be floated off or onto it;
- there are various types of ramp systems, but the most economical and efficient is the ramp;
- the recommended construction material for the ramp is concrete, although gravel or wood are also used;
- standard ramp width is 3.0 m; double 6.0 m wide;
- the length of the ramp varies depending on slope of the shoreline;
- it is important that the ramp cross the soft shoreline and extend far enough into the water to permit its use at any expected water level;
- at heavily used areas, multiple ramps should be considered;
- 2-4 lanes of boat launching, 10 lanes maximum;
- should provide a courtesy dock at each launching area;
- other launching systems include hoists, pull-up, rollers, and tractors;
- these may be considered in special-use areas or where the launching of very large boats will occur.

10.6 ASSOCIATED PARKING:

- parking should be located within a short walking distance from the ramp to avoid confusion and prevent hazardous car-pedestrian situations;
- provide stalls for cars and trailers, as well as for trailers alone;
- pull-through stalls recommended rather than a double row of head-in stalls; this allows the driver to head into the stall when parking, and to drive straight ahead to get out of the

stall rather than having to back up;

- consider separating the lot for cars, without trailers, to avoid confusion;
- when the topography does not permit this type of development, standard parking facilities can be substituted with special provisions made so that trailers may be locked to a post, rail or other fixed object or units may be parallel parked; in this case, 2 stalls should be allocated for every car-trailer unit;
- the parking lot should be separate from immediate launching ramp, turnaround and access road;
- the parking lot should be adequately drained and surfaced, i.e. all-weather surface such as gravel is recommended;
- if vehicles are parked near the water's edge, the cars should be parked sideways on, or adequate barriers should be provided to stop vehicles from rolling into the water.

10.7 OTHER COMPONENTS:

- washrooms on site may be warranted if use is heavy;
- 1 fixture per sex for every 150 cars;
- if there are more than 300 cars, consider supplying gas, food services, and other supplies on site;
- drinking water should be provided on or near site;
- ramp can be associated with, but separate from, swimming facilities due to potential pollution and noise and safety problems;
- provide life-saving apparatus;
- picnic sites with tables, benches, fireplaces and wood, as well as campgrounds can be considered in association with construction of the boat launching ramp;
- the picnic sites should be located within a short walking distance.

10.8 SELECTED REFERENCES

DeChiara, Joseph and Callender, John Hancock. Time-Saver Standards For Building Types. New York: McGraw-Hill Book Co., 1973.

U.S. Department of the interior National Park Service. Marinas, Docks, Boat Launches: Details of Construction. n.p.: Department of the Interior National Park Service.

11. TRAILS

objective:

to provide the park visitor with access into special areas for wilderness experiences, physical exercise and education.

11.0 TRAILS:

11.1 TYPES OF TRAILS:

- hiking
    - wilderness
    - backcountry
    - day-use
    - walking paths (including for the disabled)
- horseback riding
- bicycle
- interpretative (self-guiding)
- cross-country ski
- snowmobile
- snowshoe
- motorcycle/dirt bike
- 4-wheel drive trucks.

11.2 TRAIL LAYOUT TYPES:

11.2.1 LINEAR:

- long distance or destination-oriented trails, i.e. provide access to backcountry areas or provide connections between facilities such as day-use areas and parking lots;
- service 2-way traffic;
- use and impact upon trail is high and could result in environmental damage if not designed or maintained correctly.

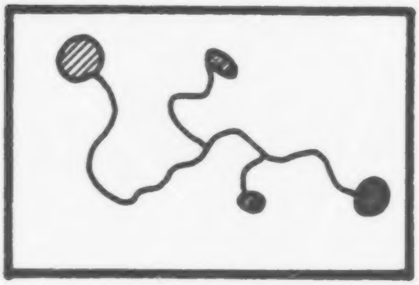

Figure 11.1 - Linear Trail Layout

11.2.2 LOOP:

- preferable on trails where users will be led back to their original starting point;
- traffic flow is one-way;
- less physical wear and tear upon the environment;
- enhances the interest level of the trail as it does not force people to retrace their steps.

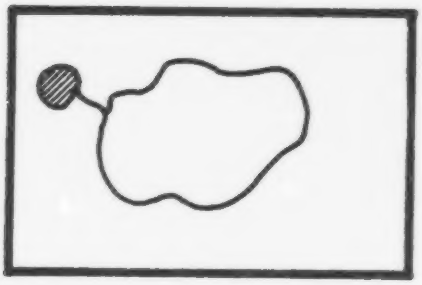

Figure 11.2 - Loop Layout

11.2.3 STACKED LOOP:

- offers the opportunity for a variety of travel distances, terrain conditions and user abilities;
- each section is preferably one-way traffic flow;
- well suited to very long trails, as it offers choices to return or continue on.

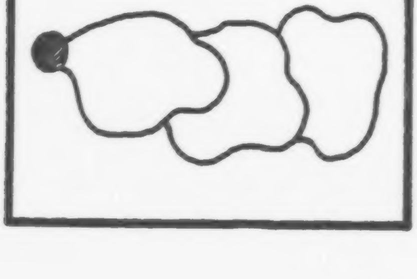

Figure 11.3 - Stacked Loop Layout

11.2.4 **SATELLITE LOOP:**

- offers the opportunity for a wide range of alternatives in distance, experiences and abilities;
- usually one-way traffic flow;
- central loop acts as a collector and the satellites offer various options in terms of difficulty, theme, etc.;
- ideal for long distances.

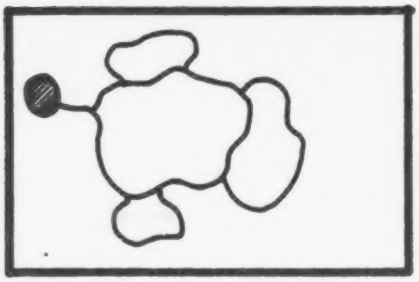

Figure 11.4 - Satellite Loop Layout

11.2.5 **SPOKED WHEEL:**

- offers a wide range of alternatives for travel distances;
- allows one-way and two-way traffic flow;
- this layout accommodates those users who tire and wish to turn back to the trail head from a number of different points;
- signing this layout is often difficult and is necessary to ensure the clarity of trail directions.

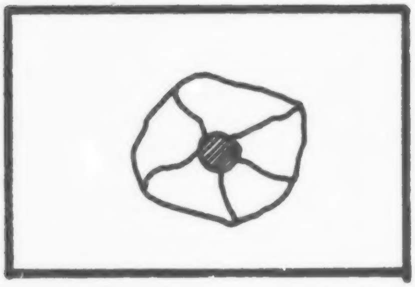

Figure 11.5 - Spoked Wheel Layout

Table 11.1
Trail Recommendations

	Wilderness	Hiking Backcountry	Day Use	Walking Paths & Disabled	Equestrian	Bicycle	Interpretive	Cross Country Ski	Snow Mobile	Snow Shoe	Motor Cycle Dirt Bike	4-Wheel Drive Trucks
RECOMMENDED LAYOUT	loop	loop	loop or linear	linear or loop	loop	loop or linear	loop	stacked or satellite loop	loop	loop	loop	loop
RECOMMENDED LENGTH	no maximum allow for 2 over-night camp	no maximum allow for 2 over-night camp	3-5 km up to 20 km	0.8-5 km	5-10 km or longer if include overnight trips	16-48 km recommend	2.5-7.5 km	novice 0.3-9.6km day trail 9.6-22.5km overnight etc. +22.5	novice 8-16 km general 24-48 km (1-2 hrs)	5-7 km up to 20km	16 km minimum no maximum	50-80 km
RECOMMENDED WIDTH OF TRAIL	450-900mm	450-900 mm	450-600mm	1.2-2 m	0.9-3 m	1.2 m 1-way up to 1.8 m	450-600 mm up to 1.8m	1.5-2.5 1 track 3-4m 2or3 tracks up to 6m on hills	2.4 m 1-way 3.6 m 2-way	1.5-1.8m 1-way 3-3.6m 2-way	1.2 m 1-way 2.4m 2-way	2.4-3.6 m
RECOMMENDED CLEARING WIDTH AND/OR HEIGHT	height of 2.5 m	height of 2.5 m	height of 2.5 m	height of 2.5 m, width of 0.6-1.5 m	height of 3.0 m, width of 2.5 m	height of 2.5 m, width of 3.0 m	height of 2.5 m	height of 3.0 m, width of 5.0 m	height of 3.0 m, width of 5.0 m	height of 3.0 m, 0.6 from trail edge	height of 2.1-3.0 m width of 2.4 m	height of 3.0-3.2 m width of 2.5 m
RECOMMENDED GRADES	0-10% 15-30% for short distances	0-10% 15-30% for short distances	0-10% 15-20% for short distances	0-3% up to 10% for short distances	0-10% 15-20% for short distances	0-8%	0-5% up to 15% for short distances	0-4% up to 10% for average skier	25% maximum	0-40%	9-15% up to 30% for short distances	7-15% up to 30% for short distances

11.3 HIKING TRAILS:

11.3.1 WILDERNESS HIKING TRAIL:

11.3.1.1 LAYOUT AND DESIGN:

- a trail experience that is as remote as possible from the influences of civilization;
- the trail should make little or no impact upon the environment;
- for hiking enthusiasts;
- one-way loop preferred;
- linear layout is acceptable;
- provide spur or loop trails to connect the main trail to areas with special features;
- no maximum length;
- allow at least two nights camping and two days hiking (for length), a day's hike is 20-40 km, 2 days is 40-80 km;
- more difficult slopes sought;
- minimum trail widths allowed;
- wide enough to define trail and maintain users' safety;
- vary widths as conditions vary;
- recommend the use of existing soils, overlying organic material for the surface, with additions of other materials only where necessary to fill wet spots, etc.;
- recommend the use of natural materials, (i.e. sand, gravel) found in the area;
- the tread surface should be crowned slightly to allow for positive drainage.

11.3.1.2 COMPONENTS:

- on long-distance trails, provide primitive campsites along the way, i.e. with area cleared for a tent, fire circle, with or without grill, pit privy;

- these should be located at intervals which are readily covered in a day's travel;
- the difficulty of the terrain must be considered, as well as the abilities, desires and speeds of the users;
- on difficult terrain, primitive campsites should be provided every 20-25 km;
- on easier, flatter terrain, 25-35 km intervals are recommended;
- rest areas recommended every 8-10 km;
- the hikers/campers should be encouraged to follow the most stringent rules of camping and hiking, (e.g. may be required to carry portable stoves in order to minimize the impact of open fires and the collection of firewood) on these trails;
- the staging area, which may be a parking lot, should be located at the head/terminus of the trail, where users can leave their vehicles for a length of time;
- provide lighting and/or other vandal protection system, as well as some form of registration;
- emergency access to these wilderness trails would be by means other than paved or cleared roadways;
- if bridges or other structures are necessary along this type of trail, they should be of the simplest construction with park-like materials (local stone, wood, etc.);
- an example of a simple bridge could be two logs strapped side by side, or stepping stones;
- these structures should be available for year-round use if the trail is open;
- important to sign the trail head, and throughout the trail, with distances and directions for convenience and safety.

11.3.2 BACKCOUNTRY TRAILS:

11.3.2.1 LAYOUT AND DESIGN:

- long-distance trails that come into limited contact with developed areas;
- views of "development" not desirable, but do not have to be completely avoided;
- should be designed for a broader range of user abilities than required of a wilderness trail;
- use additional spurs to provide access to other trails or to special features;
- no maximum length limit;
- allow for 2 nights/days on trail;
- generally slopes are gentler with fewer uphill climbs than the wilderness hiking trail;
- fluctutate trail widths with terrain conditions;
- minimal ground clearing;
- remove only that which defines the trail and could prove to be an obstacle or dangerous to the user;
- recommend the use of existing soils and organic material with extra material used only where it is necessary to improve wet sections for surface materials;
- recommend using sections of abandoned logging roads, fire access roads, hydro rights-of-way, etc.

11.3.2.2 COMPONENTS:

- this type of trail requires more "services" than the wilderness hiking trail;
- recommend 20-25 km between campsites on difficult terrain;
- recommend 25-35 km between campsites on easier terrain;
- this is based on fact that the average hiker covers 3-5 km per hour, and hikes 5-7 hours in a day;
- rest stations should be provided every 8-10 km;

- emergency access routes will be by means other than a paved or cleared trail;
- staging area at head/terminus of trail, usually a parking lot;
- parking lot should have lights or other vandal deterrents;
- provide on-site registration to ensure visitor safety;
- proper signing required to ensure safety of the user, i.e. directional signs at trail head and along the route, distances to services, directions at trail junctions, lengths of trails, etc.;
- at campsites provide fireplaces, firewood, pit privies, possibly an all-weather shelter, all of better design and construction than those along the wilderness hiking trail;
- recommend the use of rails where the bridge deck is more than 1.2 m above the stream bed or over fast-moving water;
- for easier walking, log-and-plank decking should be at right angles to the length of the bridge;
- variety of recommended bridge types to choose from: log stringers with granular fill, boulders with granular fill, log decking on stringers, plank decking on stringers, plank decking on sills, plank decking on posts, plank decking on styrofoam floats;
- provide steps where there are short steep climbs, while switchbacks are preferable for long, gentle slopes;
- where lots of steps are required, use a series of short flights of 10-14 steps each, with generous landings;
- 300 mm is smallest recommended tread for outdoor use;
- recommend a minimum of 3 steps (less is dangerous);
- recommend crowning the trail surface for positive drainage.

11.3.3 DAY-USE HIKING TRAILS:

11.3.3.1 LAYOUT AND DESIGN:

- for people who seek an experience similar in character to the wilderness or backcountry hiking trail, but do not want to travel great distances;
- contact with "development" not seen as a detriment as it is with the wilderness/backcountry trails;
- accommodate a broader range of users than wilderness or backcountry hiking trails;
- generally not used overnight;
- may be part of a more extensive hiking system;
- where this trail type is not part of a more extensive trail system, a form of closed system will be more suitable for layout, i.e. stacked loop, satellite loop or spoked wheel;
- single loops are less desirable as they provide less potential for a variety of experiences;
- linear layout forms are not desirable as they encourage 2-way traffic;
- control access to the trail, as the potential for a negative environmental impact is high due to the trails location in intensely developed areas;
- average hiker covers 3-5 km per hour, and up to a 4-hour walk;
- recommend an average trail length of 3.5-10 km, up to 20 km;
- fairly gentle grades are recommended, compared to the wilderness and backcountry trails;
- if heavily used, increase the trail width;
- if lightly used, the trail can be narrower;
- on trails or sections of trails intended for more experienced hikers, the widths could be reduced to a minimum of 0.4 m with the maximum width being 0.9 m;
- the ground and height clearances should be sufficient to provide a safe, well-defined trail, but do not encourage cutting;

- it is important that the trail surface be smooth or gently sloping;
- recommend crowning the surface to allow for positive drainage (cross slope 2:1);
- use existing soils where they are capable of bearing the high level of use.

11.3.3.2 COMPONENTS:

- rest stations should be provided every 5-10 km;
- provide on-site or access to picnic areas with tables, shelters, fireplaces, firewood, toilets, potable water, and waste receptacles;
- more extensive use of bridges, stairs, handrails allowed.

11.3.4 WALKING PATHS (INCLUDING TRAILS FOR THE DISABLED):

11.3.4.1 LAYOUT AND DESIGN:

- this trail type is found in intensely developed areas;
- usually service or recreation oriented;
- examples of this trail type are interior campground trails, pedestrian connections to facilities, or leisurely walking trails;
- must accommodate the greatest range of user abilities from the fit to the unfit, the old and the young, and the disabled;
- thus the design and construction must achieve high standards of safety, comfort, usability and aesthetics;
- the layout is usually linear, as these paths serve to connect facilities, although the loop layout is also acceptable;
- the grades should be as gently sloping as possible;
- use of ramps recommended rather than or in addition to stairs;

- provide level areas for resting at the end of each ramp (2 m is recommended);
- provide a level area at all turning points;
- do not crown surface excessively as it is difficult to negotiate by the disabled;
- maximum length of a long ramp is 18 m at 5%;
- maximum length of a medium ramp is 13 m at 6%;
- maximum length of a short ramp is 9 m at 8%;
- recommend a firm, smooth, non-slip, all-weather surface for the path;
- consider using a different colour/material/texture to delineate changes in direction and grades, as well as differences in use, e.g. vehicular vs. pedestrian;
- maintain the surface so it is free of irregularities;
- if the use is to be light, existing compacted soils and organic matter can be used;
- if the use is to be heavy, and soil conditions are not suitable for trail development, recommend the use of other materials;
- the best material depends on the particular local conditions;
- where the use is solely pedestrian, crushed stone, and/or wood chips are good materials (to a depth of 75-100 mm);
- crushed stone may create interior maintenance problems for buildings, if it is not set into path properly (scratching of wood floors, etc.);
- wood chips, used over a natural surface, help prevent erosion, retard dust, are natural in appearance but compact and disperse easily, and require maintenance and/or partial replacement every 1-2 years;
- wood chips are not recommended for trails intensively used by the disabled;
- recommend crushed compacted stone, asphalt or concrete as surfaces to allow use by all types of visitor (to a depth of 100 m);

- if trails are to also serve as access routes for service vehicles, they will require a deep base and sub-base (150 mm).

11.3.4.2 COMPONENTS:

- rest stations/benches should occur every 0.5-2 km, depending on total trail length;
- include lighting (if trails are used in the evening), waste receptacles, benches and drinking fountains at rest stops;
- important to sign the trail head, and along trail to ensure users convenience and safety;
- staging area at trail head, usually a public meeting place, i.e. campground office, picnic ground, etc.;
- provide a parking lot, bicycle stand (if bicycles are used to reach the trail);
- bridges, steps, ramps, handrails, etc., should all be to the best standards of design and construction;
- recommend a smooth transition from the trail surface to bridge/ramp surfaces;
- decking should be laid perpendicular to the direction of travel;
- all furniture should comfortably accommodate the disabled.

11.4 HORSEBACK RIDING TRAILS:

11.4.1 DESIGN AND LAYOUT:

- the intent is to provide trails for horseback riding;
- riding is usually a short-term activity (but overnight camping trips are becoming popular);
- heavy repeated use can create serious environmental damage;
- in winter, if trails are not used by the horses, they can be used as cross-country ski, snowshoe or snowmobile trails;

- loop layouts are recommended for day-use trails;
- linear trail layouts are acceptable if the environment can withstand the impact of 2-way traffic;
- provide extra spurs, loops, etc. to provide a variety of experiences and allow for detouring (to avoid wet areas in spring, etc.);
- recommend south and south-west slopes (for trail location) as they are drier, since exposure to the sun and prevailing winds results in faster snow melt and drying of soils;
- the trail length depends on the terrain, type of ride, etc.;
- 5-10 km to hundreds of kilometres (expecially if overnight camping facilities are available) are possible;
- trail widths vary with terrain conditions;
- the rougher the terrain, the narrower the trail;
- the gentler the terrain, the wider the trail can be;
- 0.9-3 m recommended trail width, with occasional greater widths to allow for passing or for riders to travel abreast;
- if the trail is to serve as an emergency or service route also, the trail must be 2.4-3.0 m wide;
- minimum trail width 0.4 m;
- the surface of the trail must be fairly even, so roots and rocks that cannot be covered should be removed;
- locate the trail in erosion-resistant soils if possible;
- provide for proper drainage by slightly crowning trail surface;
- wood chips are an acceptable surface material as they form a mat-like surface, hold moisture, but still allow infiltration of surface water, but do require some maintenance to keep a constant surface;

- crushed, compacted stone, or sand, are better surface materials as they allow sufficient drainage, are reasonably priced, provide a fairly hard surface and require virtually no maintenance;
- the depth of material and the amount of compaction required depends on local soil conditions, intensity of use and material (50-101 mm);
- prohibit use when trail conditions are unfavourable to avoid excessive damage to it.

11.4.2 **COMPONENTS:**

- campsites (if provided) should be located at a comfortable day's ride (distance: 4-6 hours ride, at an average of 15 km/hour is 60-90 km);
- all rest areas and campsites should provide a hitching rail of wood, pipe or cable;
- at site, provide potable water, fire circle, firewood, trash receptacles;
- the staging area for horseback riding trails should be at trail head, which is generally a riding stable;
- provide a parking lot, with lighting if used overnight;
- if riders use the trail alone provide on-site registration;
- the trail must be properly signed at the trail head, junctions and along the route to inform the rider of alternatives, dangers, distances and directions;
- any bridges should be sturdy so that the horses' footing is secure (1-3 m wide for horses, 2.4-3 m for service vehicles;
- if logs are used for decking, the top surface must be flattened since rounded surfaces are difficult for horses to walk on;
- there must be no movement of structures as horses walk upon them;

- a thick layer of surfacing (sand, gravel, earth) should be placed over culverts so that no hollow sounds are created when horses walk upon them;
- all corduroy work should be covered with soil or other surfacing material to provide an even tread;
- on steep slopes reinforce the outside of the tread, as horses will often walk on that edge and this can lead to erosion;
- rocks or short sections of logs could be used as reinforcement;
- avoid environmentally sensitive areas.

11.5 BICYCLE TRAILS:

11.5.1 LAYOUT AND DESIGN:

- bike trails are used by people on bicycles for recreation, physical fitness or as a circulation route, or a combination of these;
- they should be separate from pedestrian and motorized vehicular traffic;
- can be multi-use, i.e. trail, cross-country skiing and snowmobile trails in the winter;
- the bicycle trail should pass through a number of different environments, etc. to provide different experiences and add interest to the trail;
- there are two different types of bike trails;
- the first is a park bicycle trail which is short-to-medium distances in length, and provide secondary access to developed areas, i.e. campgrounds, beaches, etc.;
- the second type of bicycle trail is the touring trail, which is a long-distance trail similar in character to the day-use hiking trail;
- locate the trail in a sheltered area, protected from prevailing winds;
- the best layout is dependent on type of trail;

- where there are a number of points to be linked by a trail, a loop layout is recommended;
- where the main function is to provide access to areas, the linear layout is recommended;
- spurs or additional loops can be used to provide access to additional features off the main trail;
- bicycle trails are most interesting with a variety of different types of curves;
- avoid sharp curves at the bottom of slopes;
- provide areas with straight run-out space to control the speed of the bicycles;
- users visibility while on the trail is important to avoid collisions;

Table 11.2
Sight Distances

Grade	Speed km/hr	Stopping Sight Distance (m) Descending	Ascending
0%	16	15	15
0%	24	22	22
0%	32	33.1	33.1
0%	40	53.3	53.3
0%	48	71.6	71.6
5%	16	15	15
5%	24	24	27.4
5%	32	38	43
5%	40	48	60
5%	48	64	81
10%	16	17.0	14.6
10%	24	33.5	21.3
10%	32	49	35
10%	40	70	46
10%	48	95	59.5
15%	16	21.4	14.6
15%	24	38	21.4
15%	32	62.5	32
15%	40	91.5	44.2
15%	48	122	55

- the trails should vary in length, with some for beginners;
- free-flowing bicycle traffic averages 16 km per hour, average range is 11-24 km to 40 km per ride;
- 4.8-8 km minimum length for a bike trail;
- touring bike trails should be much longer and can be linked into campgrounds along the way for overnight use;
- considerations must be given to the conditions of the terrain and features of interest along the trail which are likely to cause the cyclists to stop along the way;
- recommend that the trail follows the topography of the area;
- the pitch of trail should not exceed 8%;
- when long grades are unavoidable, provide frequent wide, level areas where the less-then-average cyclist can dismount and rest;
- the grade is dependent on the length of the slope;
- maximum grade is 15% for 30.5 m, minus 1% from the above specification for each additional 15.25 m of length;
- maximum of 5% for lengths greater than 305 m;
- the horizontal alignment of this trail type is also important;
- the minimum curve radius is 2.5 m;
- a comfortable curve radius is 4.6 m;
- the recommended curve radius is 6.1 m;
- super elevation should be avoided where possible and should not exceed 12% if used;
- provide curb cuts at all locations where necessary;
- average bike speed is 11-40 km/hour;
- reduce speeds in areas with special features;
- design for speeds up to 40 km in downhill areas (slopes greater than 5%);

- recommend the use of a centre crown for drainage of 2-way trails;
- use centre crown or 2% cross slope for 1-way trails;
- drainage grates should have openings running perpendicular to the cycling direction;
- the drainage grates should be less than 19 mm apart.

11.5.2 **COMPONENTS:**

- rest stops should be provided every 8-15 km on short trails, every 60-70 km (3-4 hour ride) for touring trails;
- these should have benches, drinking water, trash receptacles and, on longer trails, washrooms;
- can link long distance trails into existing picnic areas and campgrounds so these services do not have to be duplicated;
- use standard bicycle trail markers and signs to prevent confusion at trail head, and throughout the trail;
- the staging area should be located at the trail head, which could be a campground, picnic area, etc.;
- if people drive their cars to reach the trail head, provide a parking lot at the staging area;
- the junctions between the trail and decks of bridges, ramps, etc. should be level;
- bridges, ramps should be at least 600 mm wider than the trail;
- at rest areas provide bicycle stands with locking devices;
- provide vehicular barriers such as bollards, where the trail meets motor vehicle routes;
- the surface of a bicycle trail must be a smooth, firm, all-weather non-slip material;
- asphalt is recommended, but it looks similar to some roads which could be dangerous;

- asphalt surface should be 50 mm deep with a 150 mm sub-base;
- asphalt is a useful material as it is less likely to become rutted, gives a smooth ride, but is fairly expensive;
- crushed and compacted stone is an alternative because it is cheaper, easy to repair, but does not give as smooth a ride;
- as an economic solution could initially construct the trail of compacted stone and later resurface with asphalt;
- avoid using loose materials such as sand or gravel, because they do not form a smooth hard surface;
- quality of a bicycle trail should be comparable to a campground road.

11.6 INTERPRETATIVE TRAILS:

11.6.1 LAYOUT AND DESIGN:

- interpretative trails should provide the public with opportunities to enjoy and to gain an understanding of natural and cultural environments;
- planning of interpretative trails should include careful selection of media to ensure that the interpretative potential is fully used;
- sites for the trail should (in most cases) be as natural as possible;
- consider the possibility of a year-round interpretative trail accessible to everyone;
- have to accommodate a wide range of user abilities, therefore, a high standard of design is required in terms of ease, comfort, safety and understanding of the user;
- develop interpretative trails on a theme basis;
- the main portion of the information that is communicated to the visitor comes from the environment, and its success depends on the skill with which the trail

route is planned, i.e. viewing positions, sequence of experiences, etc.;

- the greater the use, the greater the maintenance requirements in order to prevent the trail from acquiring an uncared-for appearance that will discourage use and encourage vandlism;
- 1-way loop layout is recommended, with satellite loops for additional variety;
- could also use spurs to provide access to features of special interest, particularly where these are sensitive or might be jeopardized if located on the main trail;
- the trail should have many bends; long straight trail sections should be avoided for interest's sake;
- twists and curves provide surprises and increase curiosity and interest;
- the length of the trail depends on the distance required to adequately communicate the message of the trail, the conditions of the trail, and the abilities and interest level of the visitor;
- 1 km to several kilometres in length is adequate in most cases;
- the maximum length is 13 km;
- the average length is 2.5-7.5 km; the average person walks 3-5 km/hr. and his/her interest level drops after 1 1/2 hours;
- occasionally longer trails are desirable, to provide access to other areas of interest (recommend spurs or satellite loops);
- maximum grade is 15% for no longer than 30 m;
- trail widths should vary;
- some sections should be wide enough for only one person to walk 0.4-0.6 m;
- other sections may be 0.9-1.8 m, which is wide enough for 2 or 3 people to walk abreast;

- at intrepretative markers or points of interest, provision of extra room so that groups can form is recommended;
- minimal ground and vertical clearance sufficient to provide a safe clear trail;
- if possible, make use of existing materials in the area to serve as surface material;
- on lightly used well-drained trails, special surfacing is not required;
- when use is expected to be heavy and/or the soil conditions are not suitable to withstand the impact, other surface materials should be applied;
- wood chips (to a depth of 50 mm) are a suitable natural material, but requires maintenance to keep the trail in top conditon and is not suitable for trails for use by the disabled;
- recommend crushed compacted stone or asphalt (to depth of 100 mm with a 100-150 mm sub-base);
- boardwalks are recommended as a solution for areas that are subject to flooding or when passing through sensitive areas.

11.6.2 COMPONENTS:

- the staging area for an interpretative trail should be at the trail head at a campground, parking lot, etc.;
- provide adequate parking if the user has to drive to reach the trail;
- correct signing is important due to the variety of users on the trail, as well as the importance of communicating the interpretative message properly (at trail head, junctions, along the route, indicating distances, directions, etc.);
- all structures, i.e. boardwalks, bridges, etc. should be wide enough to allow easy passing, especially where people may stop to enjoy the scenery;

- boardwalks should be at least 1.2 m wide;
- railings should be provided in any potentially dangerous area;
- provision of rest areas on longer trails (i.e picnic areas half way on trail or at a particularly attractive site, tables, trash receptacles, washrooms, drinking water).

11.6.3 SUBJECT MATTER:

- the subject matter should dictate the trail's route, with features that illustrate a coherent idea at each step;
- preferable to restrict interpretation to stopping points, not in between markers;
- duration of interest for the average user is 1 1/2 hours;
- research shows that approximately 10 stopping points per trail are recommended.

11.7 CROSS-COUNTRY SKI TRAILS:

11.7.1 LAYOUT AND DESIGN:

- cross-country ski trails are definitely not compatible with snowmobile trails;
- cross-country ski trails could follow the route of existing hiking trails (for dual season use);
- trails must be well designed as they will service a variety of different user groups (amateur, racer, fitness buffs, etc.);
- the loop layout (stacked loop, satellite loop or spoked wheel) is recommended;
- these provide a variety of routes which could also provide different dagrees of difficulty and distances;
- the trail should be protected from prevailing winds, i.e. the leeside of hills or in tree cover for the comfort of the skier and to reduce drifting and wind

packing of the snow;

- should locate the trail in sunny, sheltered areas;
- the early trail sections should be sheltered and uphill, so that skiers warm up at the beginning of the trail;
- slopes at the end of long trails should be gentle as lighting in the late afternoon is poor, conditions are often icy and the skier may be tired;
- retain vegetation as a buffer between developed areas and the trail, as the trail user generally desires a wilderness type of experience;
- consider the potential environmental impact of the trail route;
- avoid sensitive areas (unique vegetation, wildlife, etc.) where compaction of the snow cover may cause damage to vegetation or erosion;
- intersections should not occur at the bottom of downhill runs;
- the length of the trail is determined by the speed and ability of the skier, the terrain and snow conditions;
- novices cover 2-5 km/hr. in 1-3 hours (2-15 km);
- intermediates cover 5-10 km/hr. in 1-3 hours (5-30 km);
- racers cover 10-15 km/hr. in 1-3 hours (10-45 km);
- short base loops should be provided for partial day-use and for use by slower or novice skiers;
- 0.3-5 km is recommended length for base loops;
- the steep runs should be relatively short so that speeds do not build up;
- a range of 12-15% grades for 100 m;
- maximum 25% slopes for distances of less than 30 m for average skier;
- provide run-out space at the base of slopes to allow skiers to slow down before curves;
- sharp curves should be tilted to the inside;

- novice trails can be graded with slopes of 10%, but curves should be wide and gentle;
- intermediate trail, maximum 25% slopes with curves sharper but space is still provided for overshooting; up to 1/3 of the trail may be uphill with some steep but short climbs;
- an expert trail can have slopes of 40%, but some gentle grades should be provided on long runs, the trail surface can be rough with some sharp curves; adequate run-out space at the bottom of steep or long slopes; should be provided up to 1/2 the trail can be uphill;
- a racing trail on flat terrain is 3.5 m wide;
- a racing trail on hilly terrain is 4.5 m wide;
- a racing trail in coniferous vegetation is 3.5-5.5 m wide;
- when grooming equipment is used on the trail, a minimum trail width of 2.5 m is required;
- a skier should be able to fall from any ski track without hitting an obstruction along the edge of the trail.

11.7.2 COMPONENTS:

- on a short trail, the distance to the rest station or warming shelter should be 3-4.8 m (or 1/2 the trail);
- on a long trail recommended 6.2-9.3 km, or up to 11.2 km distance between rest stations;
- the distance depends on the skiers' ability and the terrain;
- recommend that the layout of long and short trails be such that they can share rest stations;
- could also link snowshoeing and snowmobile trails, so that they all share common facilities;
- on trails that provide for overnight camping, cross-country skiing, rest stops should be 15-20 km which is a distance readily covered in a day;

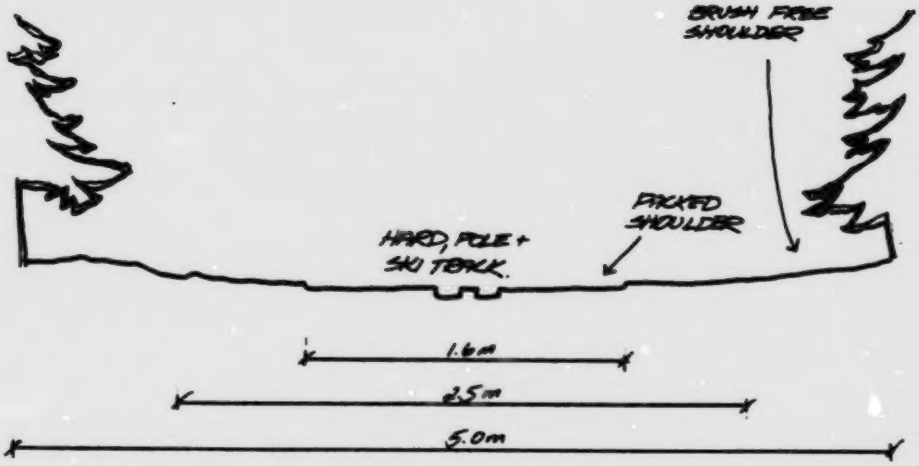
BRUSH FREE SHOULDER
PACKED SHOULDER
HARD, POLE + SKI TRACK.
1.6m
2.5m
5.0m

Figure 11.7 - Single Cross-Country Ski Trail

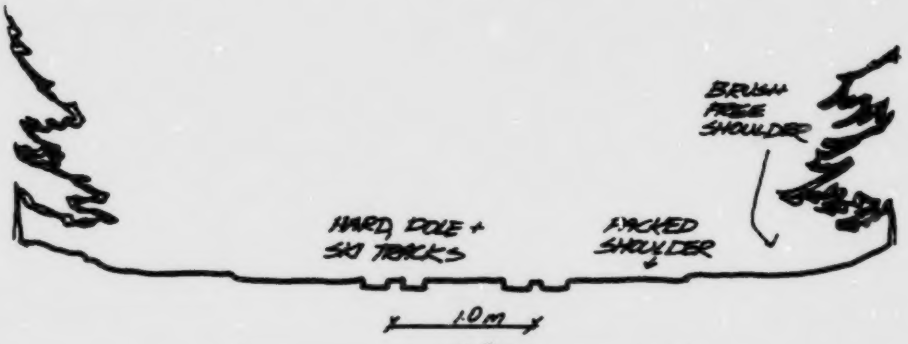
BRUSH FREE SHOULDER
HARD, POLE + SKI TRACKS
PACKED SHOULDER
1.0m
2.8m
3.2m
50m.

Figure 11.8 - Double Cross-Country Ski Trail

- the staging area should be situated at the head and terminus of day-use trails;
- recommend the provision of a parking lot, with shelter, heated washrooms, drinking water, first aid station, telephone and, possibly, a food concession;
- the parking lot should provide ample room for parking, unloading and maneuvering in snowy and icy conditions;
- if to be used in the evening or for overnight use, provide adequate lighting in parking lot, on trails and around the shelter;
- it is necessary to adequately sign all trails, above the snow, so that confusion or accidents do not occur;
- the warming shelters or rest stops should be heated and lit and provide washrooms, drinking water, and a place to sit and rest or eat lunch;
- provide railings on all structures (bridges, ramps) that might prove dangerous;
- all structures should be wide enough and durable enough to support maintenance equipment (track setter, etc.);
- shallow streams that do not require bridges, could use a brush fill instead;
- avoid locating bridges at the ends of downhill runs;
- recommend locating services (e.g. warming shelters) at trail junctions so that maximum number of skiers (or others) can take advantage of them.

11.7.3 MAINTENANCE:

- pre-season maintenance should include clearing of the trail after summer regeneration, repairing structures, etc.;
- all work should be done carefully to keep environmental damage to a minimum;

- during winter months, it is necessary to "set" the hard parallel track and pack the poling area for skiers' use;
- should use a snowmobile and a track setter for this;
- good maintenance of the trail creates a more pleasurable skiing experience.

11.8 SNOWMOBILE TRAILS:

11.8.1 LAYOUT AND DESIGN:

- these trails provide for motorized travel on snow or ice;
- two different snowmobiling experiences: on trails and in open fields;
- the most enjoyable trails combine the two types;
- snowmobiling is not compatible with other winter activities such as cross-country skiing, and must be separated physically and visually;
- snowmobiling can lead to environmental damage, if snow depth is less than 101.6 mm deep;
- where possible, use suitable existing trails, old logging roads, fire lanes, abandoned road-beds or utility rights-of-way for trail location;
- avoid all structural and natural hazards, e.g. fences, guy wires, cliffs, banks and open water;
- trails should pass through a variety of terrains, vegetation and scenery;
- the design of the trail should consider both daytime and nighttime use;
- trails should occasionally pass through open areas where users can picnic, rest or "open up" their machines;
- a one-way-loop layout is preferred as it brings the user back to his/her starting point;
- a one-way system is safer, faster and maximizes variety;

- the main trails should not be routed through areas of special scenic or historical interest;
- all trail programs should contain shorter alternative routes within the main loop area;
- the spoked-wheel layout is also useful as it allows the user to go out for a short time, return, warm-up, and take another trail out and return;
- most users dislike trails that test snowmobiling ability or endurance too much;
- the recommended length is 8-16 km for short loops, 24-48 km for average loops, up to 72 km as maximum for long loops;
- a novice's loop is recommended at the beginning of trail, with a length of 1.6-8 km;
- the main trail should not exceed two hours in average travel time;
- the maximum slope should be no greater than 25% to ensure safe and easy travel;
- approaches to steep slopes should be straight and as long as possible;
- on long grades or those greater than 25%, the need for alternative level routes should be anticipated to bypass these sections during adverse weather or for novices;
- trails should cross at right angles to contours and should not transect side slopes;
- 1-way trail width is 1.2 m minimum;
- 1-way trail width of 2.4 m recommended;
- 3.6 m is maximum 1-way trail width;
- a 2-way trail of 3.6 m is recommended;
- widths should vary with topography, curves and intersections;
- the faster the anticipated speeds, the wider the clearing width;
- a minimum of 3.0 m is required for maintenance vehicles;

- leaning or damaged trees within 9 m of the trail's edge should be removed to prevent their falling onto the trail during heavy snowfalls or due to strong winds;
- the turning radius for a snowmobile is 7.5 m;
- a 15 m minimum sight distance from the trail (horizontal and vertical) is recommended;
- snowbanks should be cut back 60 m in both directions when crossing a road, trail or other road or trail intersection;
- sign all road crossings properly.

11.8.2 COMPONENTS:

- for control and maintenance, designate a staging area within the park limits to act as the hub or gathering centre from which all activities originate;
- provide parking lot (for cars and trailers) with lighting;
- provide warming shelters, washrooms, trash receptacles, drinking water, a telephone, first aid stations also;
- recommend strict control of access to the trail to avoid undesirable traffic flows and to maintain a safe pleasant trail;
- warming shelters at 10-20 km intervals;
- bridges at least 2.4 m wide, well constructed to support snow cover and maintenance equipment;
- railings recommended;
- main trails should not be routed over lakes, streams or other bodies of water in fall or spring.

11.9 SNOWSHOE TRAILS:

11.9.1 LAYOUT AND DESIGN:

- intent is to provide trails that allow users to snowshoe without interference;

- snowshoeing is compatible with cross-country skiing, although the possibility of covering much rougher or steeper terrain on snowhoes is possible;
- could possibly use the summer hiking trails;
- spur or satellite loop layouts can be provided for intermediate and advanced snowshoers;
- the trail should be located so that it is protected from prevailing winds, i.e on the lee side of hills or in tree cover;
- the first sections of the trail should be sheltered and uphill so the users can warm up;
- use buffers of vegetation to shield the trail from developed areas and other trails, as snowshoers generally prefer a "wilderness" experience;
- a 0.9 m trail is the minimum trail width.

11.9.2 COMPONENTS:

- locate the staging area at the trail head/terminus; provide a parking lot, a warming shelter, washrooms, drinking water, first aid station and a telephone;
- since other winter activites need similar staging areas, recommend sharing these facilities (i.e. common staging area, warming huts);
- for snowshoeing trails, it is not critical that warming shelters be provided unless the trails are very long;
- all trails should be signed properly at the trail head and throughout the trail for user safety and information.

11.10 MOTORCYCLE TRAILS:

11.10.1 LAYOUT AND DESIGN:

- to provide trails for the use of recreational motorcycles/dirt bikes;
- there are definite areas where this type of activity should be prohibited, i.e. in ecologically sensitive

areas, in areas of geological or archaeological significance, in locations where such use could be detrimental to endangered wildlife habitat or nesting areas, and in locations that are established primarily for another recreational use;

- if the trail is not properly designed and managed, it can have a negative effect on the environment;
- recommend providing a novice loop, as well as longer, more challenging trails through a variety of different environments;
- recommend following contour lines of the terrain;
- fit the trail into the surroundings through careful design and construction;
- avoid sharp curves on the trail;
- avoid long straight stretches on other than smooth surfaces;
- allow perpendicular hill climbing in designated areas only;
- use abandoned roads, railway lines and other rights-of-way as trail sites, prior to the construction of new trails;
- include adequate turns and a variety of views to satisfy the user;
- the trail should provide a challenge to the riders;
- vary terrain, scenery, locations and difficulty of the trail for interest, too;
- avoid moisture on trail surface for long periods of time;
- 0-7% is the recommended slope;
- up to 30% slopes for 90-135 m distances only;
- 55% is absolute maximum slope;
- provide for turns to be made on level areas of less than a 3% slope for safety;
- 1.2-1.8 m is recommended for 1-way trails;
- 2.4-3.0 m is recommended for 2-way trails;

- 1.8 m minimum radius on switchback;
- 3.0 m maximum radius on switchback;
- 1.5-2.4 m clearing for 1-way trails with a maximum of 3.0 m;
- 2.4-3.0 m clearing for 2-way trails with a maximum of 3.6 m;
- use the existing natural material for the base of the trail where possible;
- use special bases if required, depending upon soil types, conditions and trail purpose;
- crown the trail surface slightly;
- if existing material is not suitable, use crushed limestone (depth of 75 mm) wood chips (75 mm) or gravel (75 mm);
- allow for natural drainage if possible;
- avoid soggy/wet areas unless the objective is to include this as part of the trail experience;
- where the trail cuts into contours and erosion is likely, allow for proper drainage systems to be constructed.

11.10.2 **COMPONENTS:**

- generally, rest areas are not necessary on motorcycle trails;
- locate the staging area at the trail head/terminus with a parking lot, drinking water, washrooms, trash receptacles, unloading ramp and registration box (if overnight trips or longer) provided;
- provide trail spurs to connect the motorcycle trail to existing picnic areas or campgrounds;
- provide adequate signing to make the trail clear and safe;
- bridges are required only when crossing major streams where the water depth is 540 mm or deeper;
- bridges should be of a height to remain above water level for 25-year floods;

- small streams, less than 450 mm deep usually can be crossed simply by driving through them;
- if this is done, stabilization of both banks is needed;
- use low culverts or fords where maintenance problems exist.

11.10.3 SPECIAL USE AREAS:

- climbs for novices recommend 5-10% slopes;
- climbs for advanced recommend 10-25% slopes;
- climbs for experienced recommend 25-55% slopes;
- for jumps, use existing topography; 10 jumps per 0.4 km is recommended;
- open areas are only desirable for beginners;
- turns - maximum is 11 turns per 0.4 km;
- turns - 2 turns per 0.4 km is the minimum;
- control noise through careful siting and planting of buffers.

11.10.4 OTHER:

- trails should be at least 180 m from the nearest campsite;
- this distance may be shortened if there are substantial hills and/or vegetation between the two areas;
- the distance may have to be longer if prevailing winds blow from the riding area towards the campsite;
- rocky slopes are suitable and desirable for experienced riders;
- rocky areas need not always be cleared for cycle use;
- enforcement is necessary to prevent unnecessary cycle riding in areas other than designated trails.

11.11 OFF-ROAD VEHICLES (4-WHEEL DRIVE TRUCKS):

11.11.1 LAYOUT AND DESIGN:

- provides trails for recreational use by 4-wheel drive trucks and other ORV's (off-road vehicles);

- these vehicles can cause significant environmental damage and major conflicts with other recreational uses may arise, therefore, these trails require careful siting and design;
- old logging roads, hydro rights-of-way, winter-trail routes (snowmobile trails are the only ones wide enough) may be used as trail locations;
- 1-way traffic is recommended because it is safer and usually less damaging to the environment;
- satellite or stacked-loop layouts can be used for long trails to heighten the challenge and provide variety in terrain and experiences;
- recommend an area of 9.4 hectares for off-road vehicle trails;
- locate the trail in a variety of topographical features with emphasis on hilly or rolling terrain;
- 7-15% recommended average grade;
- up to 30% slopes for 91-137 m distances are permissible.

11.11.2 COMPONENTS:

- locate the staging area at the trail head/terminus with a parking lot provided;
- trail could also begin at a wayside or a campground, etc.;
- lighting, washrooms, drinking water, first aid, telephones, registration (if for long distances) and information are to be provided on site, at trail head;
- proper signing should occur at the trail head and along the route, informing, directing and regulating the user;
- could link this trail system into picnic, beach or campground areas via short walking trails.

11.11.3 ENVIRONMENTAL CONDITIONS:

- recommend soils that are gravelly well-drained sandy-loams to loamy textured;
- sand or rock on slopes is recommended;
- avoid flood-prone areas, areas with water table close to surface or imperfectly drained areas;
- avoid areas with rare or endangered floral species;
- avoid areas with high wildlife habitat capabilities;
- buffer between surrounding areas and proposed site to control access, and prevent trespassing and vandalism;
- buffer should be at least 1.2 km wide if open land is used as the buffer;
- recommend a buffer of vegetation at least 0.8-1.2 km thick;
- keep the trail locations away from major population areas (due to noise and safety factors).

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12. INTERPRETATIVE STRUCTURES

objective:

to provide devices that further the interpretative experiences of the users and to ensure their safety.

12.0 SPECIAL INTERPRETATIVE FEATURES:

12.1 BOARDWALKS:

- provide access into areas that are perpetually wet, are prone to flooding, contain unique and/or sensitive natural components (vegetation, wildlife, etc.) or are unsafe or difficult to walk in;
- 0-5% is the recommended grade;
- for 2-way traffic, the boardwalk should be 1.9 m wide.

12.1.1 GENERAL:

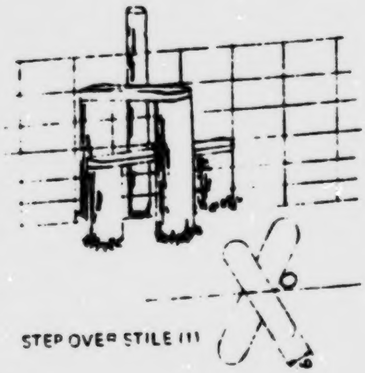
- 10% grade is the minimum grade (if access is not provided for the disabled user);
- boardwalks are usually constructed of wood planks and beams;
- planking should be perpendicular to the direction of travel;
- railings should be employed in any situation that might be hazardous to safety of user;
- double railings are recommended, with heights of 1.1 m and 0.84 m;
- provide kick-plate or an edge, at foot height on the boardwalk for safety.

12.2 VIEWING AT OBSERVATION TOWERS:

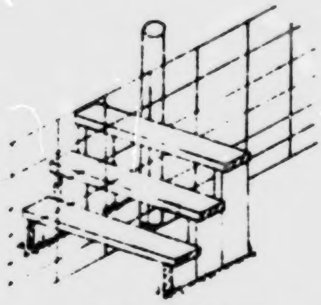
- towers are used to view a greater expanse of the surrounding area and this provides excellent opportunities for interpretation;
- for details design/construction plans for 6.0 m, 12.2 m, 18.3 m towers see: The Drafting Section, Parks Branch Drawing File;
- they are generally constructed of a rustic, natural material such as wood;
- access to the tower and the tower itself, must be well designed and constructed to ensure the user's safety;
- the tower may usually be climbed from an outside ladder, or from an inside staircase;
- the viewing platform may be open-sided, partially enclosed or totally enclosed (with windows);
- encourage the use of observation towers as they provide a unique view of the surrounding environments.

12.3 BARRIERS:

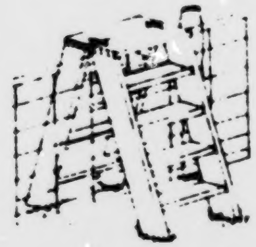
- prevents people/animals/vehicles from entering areas they do not belong in, or are unsafe for them, and also aids the direction of traffic through a given area in order to minimize conflicts;
- recommend a rustic material such as wood or boulders so the barrier blends into the environment;
- other fencing materials useful as barrier systems are wood bollards, wood stumps, log fences, rock piles, vegetation, barbed wire;
- barriers can be either movable or permanently placed on site;
- fencing can be used as a barrier to animals, also;
- gates in fencing are very expensive,(and too often left open and fail in their purpose);
- stiles are an alternative to gates;
- stiles are constructed of timber or stone and are designed in such a way as to allow a person to climb over the fence or wall with relative ease, or to pass through a gap that is too small or complicated for large animals;
- provide a handhold at the cross-over point for the safety of the user.



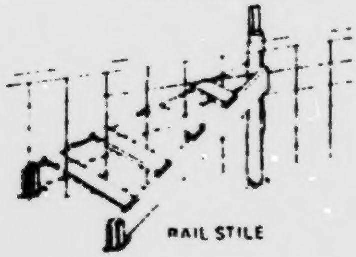
STEP OVER STILE (1)



STEP OVER STILE (2)



PORTABLE STILE



RAIL STILE

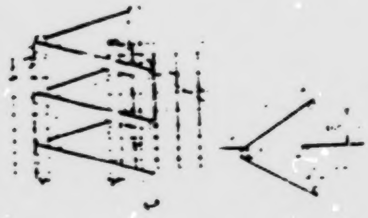


Figure 12.1 - Access Through Barriers

12.4 SELECTED REFERENCES

Douglass, Robert W. Forest Recreation. New York: Pergamon Press Inc., 1975.

Irwin, John. "Guidelines for Barrier Free Access in Manitoba Provincial Parks". unpublished: Department of Natural Resources, Park Branch, 1983.

Sternloff, Robert and Warren, Roger. Park & Recreation Maintenance Management. Boston: Allyn & Bacon Inc., 1977.

13. CAMPGROUNDS

objective:

to provide overnight accommodation for people on a transient and/or seasonal basis.

13.0 CAMPGROUNDS:

- 4 different campground types: primitive, road access with non-modern services, road access with electricity and modern washrooms, and road access with fully serviced individual sites;
- types of camping varies from tent camping, tent trailer, camper pickup to motor home;
- recommended campsite slopes are 2%-5%;
- recommended maximum slope is 10%-15%;
- maintain the natural character of the site by carefully locating each campsite;
- maintain the vegetation on site for shade, physical and visual buffers and protection from the elements;
- orient campsites on south-eastern, south-western or southern slopes;
- situate campsites on higher ground as low areas are generally wet and humid, collect cold air, smoke and mist, and promote insect breeding;
- the main campground road should be 2-way and located to permit easy ingress/egress from the main arrival point and campground itself;
- recommend that the internal campground roads be 1-way for safe and uncomplicated travel;
- recommend 1-5 campsites per hectare for low density campgrounds;
- recommend 5-18 campsites per hectare for medium to high density campgrounds;
- allow a minimum of 15 m on centre between campsites;
- 15-60 m is the recommended distance between campsite centres;
- potable water should be within 45 m of each campsite, or a maximum of 90-150 m away;
- one water outlet should serve 8-10 campsites;
- washrooms should be located a maximum of 120-180 m from the furthest campsite;

- provide at least one heated washroom for winter campground use;
- provide buffers 150 m wide from the campsite to a major road;
- provide a buffer 60-90 m wide from the campsite to a secondary road;
- recommend that a campground loop road contain no more than 125 units per loop;
- there are two interior campground road types: the pinwheel and the loop layout (see Figure 13.7 and 13.8) (the loop layout is usually recommended);
- parking for the campsites can be either on or off the campsite;
- preference by users is on-site parking, except for primitive walk-in or boat-in campgrounds where off-site parking is preferred;
- on-site parking is handled either in a pull-through, back-in or parallel layout;
- recommend the first two parking layouts in most cases (i.e. pull-through or back-in);
- 90% of all campsites should be located to the right of the parking spur (when vehicles are backed in, because the entry/exit door is on the right of the unit);
- service hook-ups should usually occur on the left or at the back since the unit hook-up is most often on the driver's side (although some vehicles have the hook-ups on the passenger side);
- 10% of all campsites should be located at the back of a parking spur for pick-up campers;
- recommend providing an area of 90 m for parking at most campsites (4.5 m wide x 19.8 m long);
- recommend providing 112 m of area for "living space" (9.2 m x 12.2 m)

- recommend a total clearing for campsite of 149 m or less (this includes living space and "breathing room";
- the amount of buffer area provided between campsites is dependent upon the vegetation, terrain and camping experience desired;
- generally 3.0-4.5 m of buffer is adequate;
- maintenance and/or regeneration programs on an ongoing basis are necessary to maintain the quality of the campground;
- allow a buffer of 31-46 m between the campsites and a body of water;
- locate the individual fireplaces 1.2 m from the bushline, and not central within the site;
- locate the picnic table at least 1.8 m from the fireplace;
- 10% of all sites should be designed to accommodate two or more families.

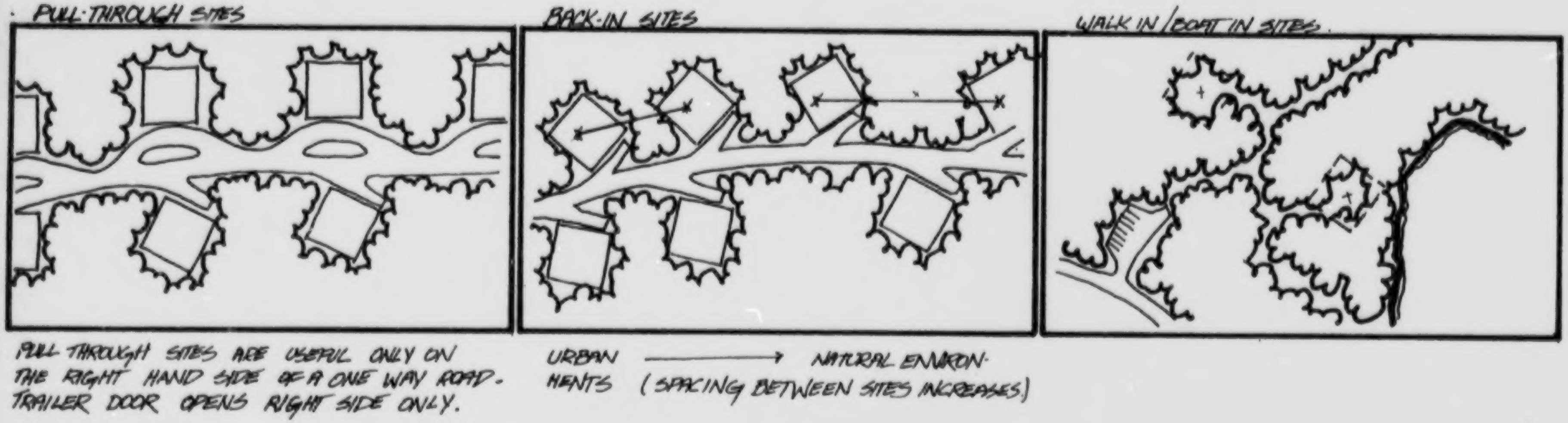

PULL-THROUGH SITES
BACK-IN SITES
WALK IN/BOAT IN SITES.
PULL-THROUGH SITES ARE USEFUL ONLY ON THE RIGHT HAND SIDE OF A ONE WAY ROAD. TRAILER DOOR OPENS RIGHT SIDE ONLY.
URBAN → NATURAL ENVIRONMENTS
(SPACING BETWEEN SITES INCREASES)

Figure 13.1 - Layout of Campsites
Source- Ministry of Natural Resources, Division of Parks, Park Planning Branch, Site Planning Section. Ontario Provincial Parks Landscape Design Principles and Guidelines. Ontario: Ministry of Natural Resources, 1977.

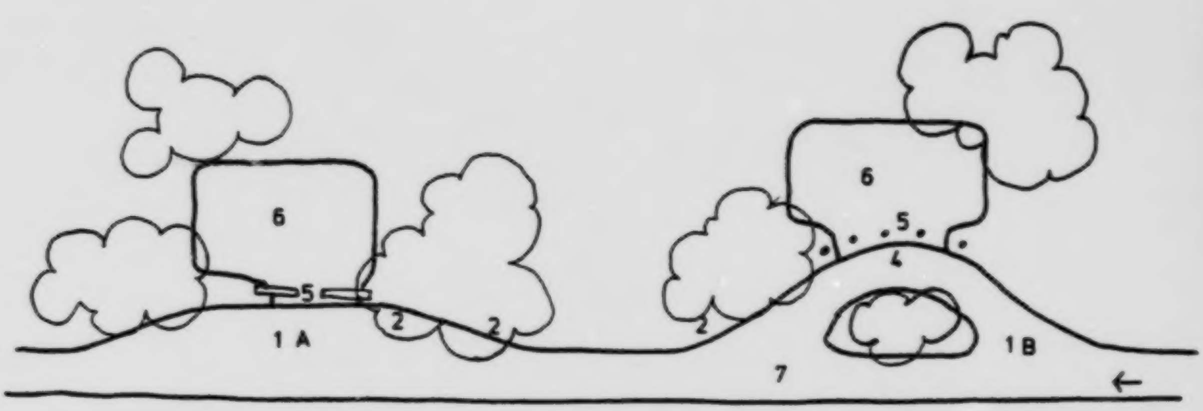


Figure 13.2 - Parallel Spur

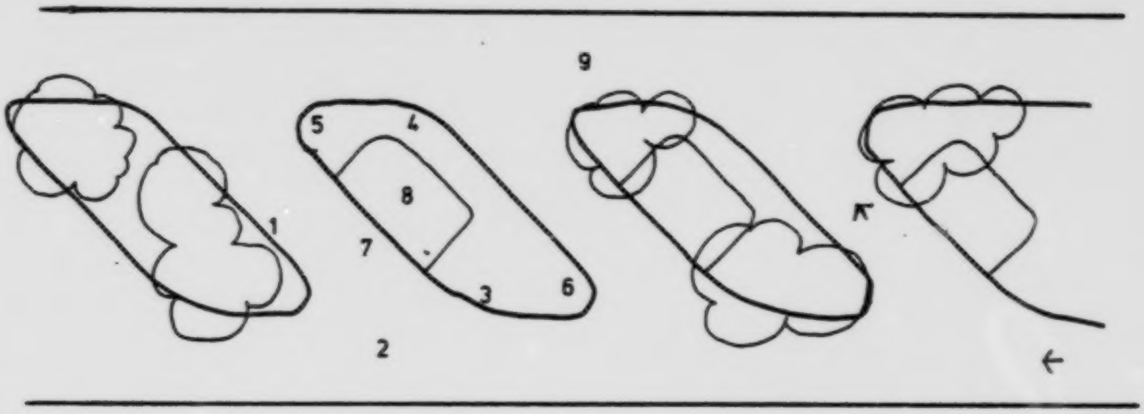


Figure 13.3 - Pull-Through Spur

		1A	1B	2
1.	Parking Spur	4m x 12m 2-5% Gradient 3:1 side slopes	4m x 29m	4m x 18m 2-4% Gradient NIL side slopes
2.		Spur radius 15m		Spur angle 45°
3.		Spur radius 1.5m		Spur angle 9m
4.		Spur radius 10 m (centre line)		Spur radius 3m
5.		Barrier (centre line)		Spur radius 1.5m
6.		Campsite surface (centre line)		Spur radius 1m
7.		Internal campground road		Barrier (curb)
8.				Campsite surface
9.				Internal road (one-way)

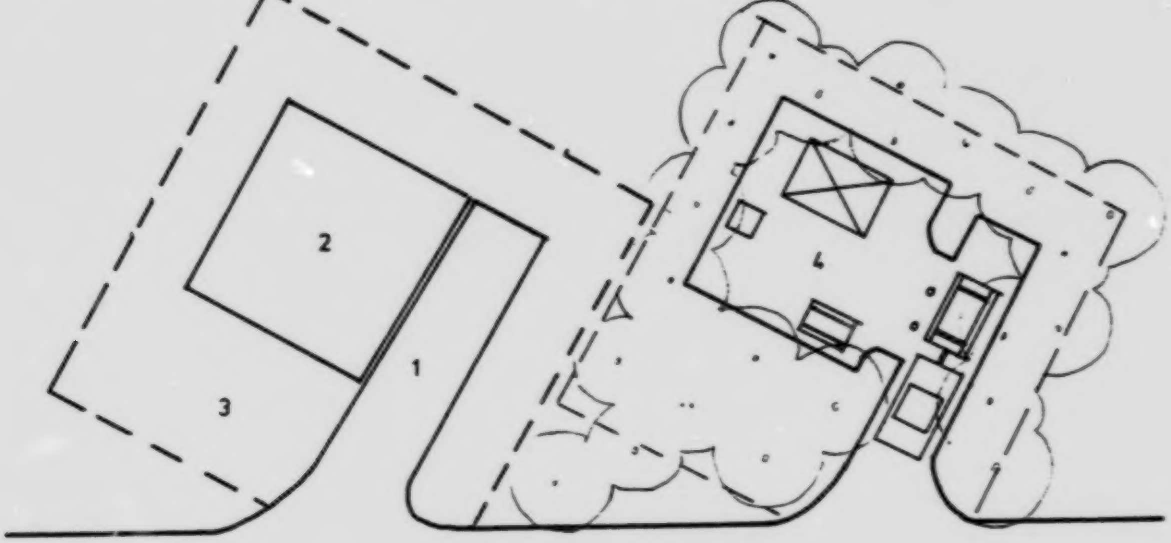


Figure 13.4 - Campsite Layout

Semi-Serviced

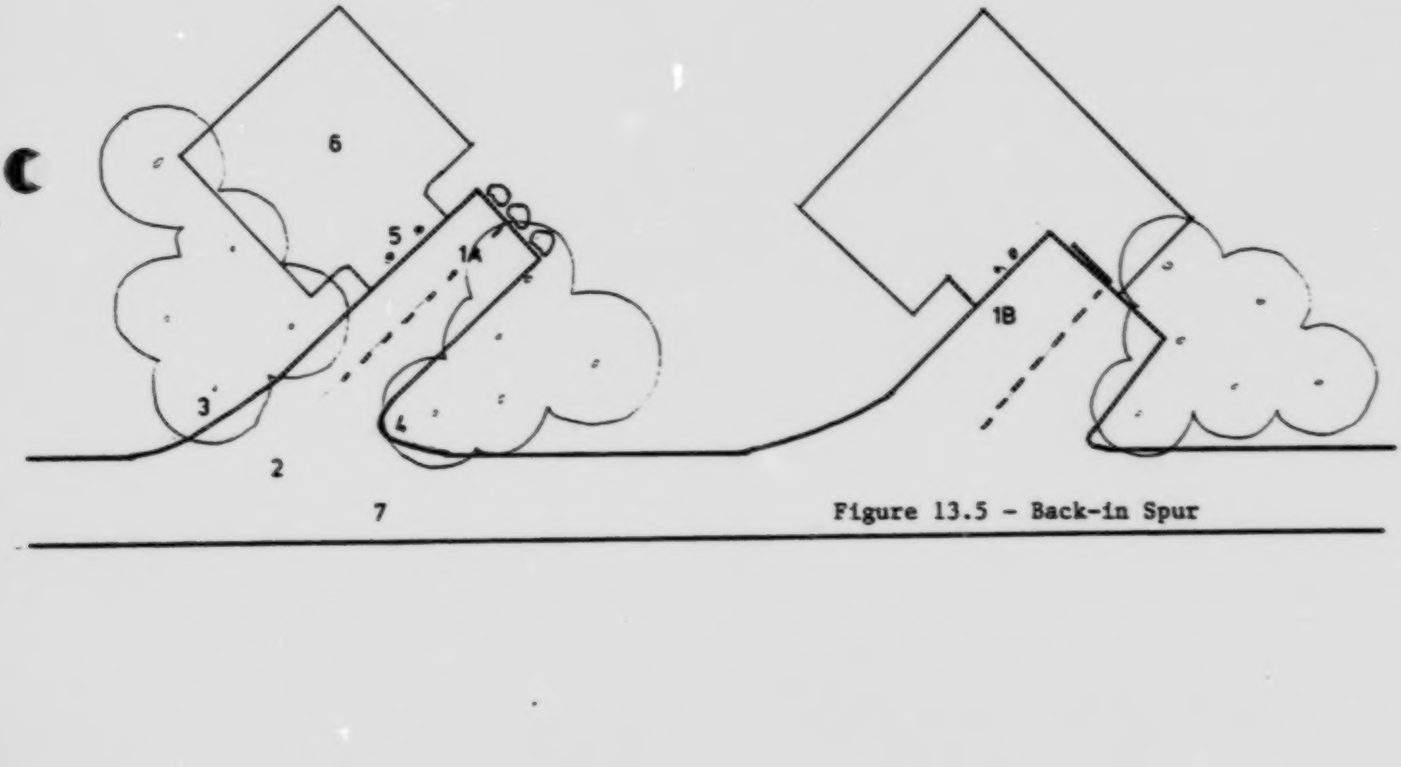

6
5
1A
3
4
2
1B
7

Figure 13.5 - Back-in Spur

KEY

	FIGURE 13.4		FIGURE 13.5	
	A	B	A	B
1. Parking	90m^2		4m x 18m 2-5% Gradient 3:1 side slopes	7m x 14m
2.	Campsite surface (110m^2)		Spur Angle 45° - 60°	
3.	Buffer (400m^2)		Spur Radius 15m	
4.	Total campsite area (600m^2)		Spur Radius 1.5m	
5.			Barrier	
6.			Campsite Surface	
7.			Internal Road	

13.1 TYPES OF CAMPSITES:

- primitive campsites provide the user with few if any additional amenities;
- they are generally walk-in or boat-in sites with vehicular access for service vehicles only;
- provision of water and washrooms of the most primitive type only (pit/vault toilets, well for water);
- road acess and tent pads with no modern facilities;
- same as above except vehicular access to each individual site is provided;
- road access with electricity and modern, central sanitary facilites (toilets, sinks, showers, laundry facilities);
- road access to fully serviced campsites provide the user with the most modern facilities and amenities of any campsite.

13.2 SITING CHARACTERISITICS:

- are determined by topography, flora, soil conditions, drainage and local climate;
- campsites oriented on east-facing slopes receive the morning sun which will dry damp sites and provide shade from the afternoon sun;
- sites oriented on west-facing slopes receive afternoon and early evening sun;
- north-facing slopes retard snow melt and retain moisture;
- south-facing slopes tend to be drier and warmer in cool weather;
- topography for a campground should be gently rolling with good drainage;
- whenever possible, service facilities should be located to coincide with roadways or trails;
- develop campgrounds on soils that can tolerate heavy use without compaction, erosion or wet conditions;

- sandy gravels or sandy loams are the most desirable for campsite development;
- individual sites should be well drained and allow for surface drainage to percolate readily;
- the general public prefers campgrounds near water bodies;
- it is important to provide visual and physical separation between individual sites;
- a vegetative canopy is necessary for shade, screening and aesthetic enhancement;
- recommend locating sites in mixed stands of vegetation with a fairly dense canopy;
- the use of indigenous plant materials is preferred (when planting is necessary);
- do not plant or clear vegetation in straight lines as it is contrary to nature's layout;
- plant in mixed, informal massings, as this is compatible to natural growth patterns.

13.3 ACCESS:

- integrate roads and parking lots into the surrounding landscape;
- the entry station (with extra space for parking second car) is important since it organizes the operation of the campground, i.e. serves as information centre, issues camping permits, collects fees, etc.;
- these entry buildings should be designed so that the users can stay in their cars if they wish when entering and registering;
- provide a by-pass lane around the entry/contact station for those users who have already registered and do not need to stop at the entry station;
- also provide turnaround provisions for vehicles (minimum radius of 9.1 m) at this point;

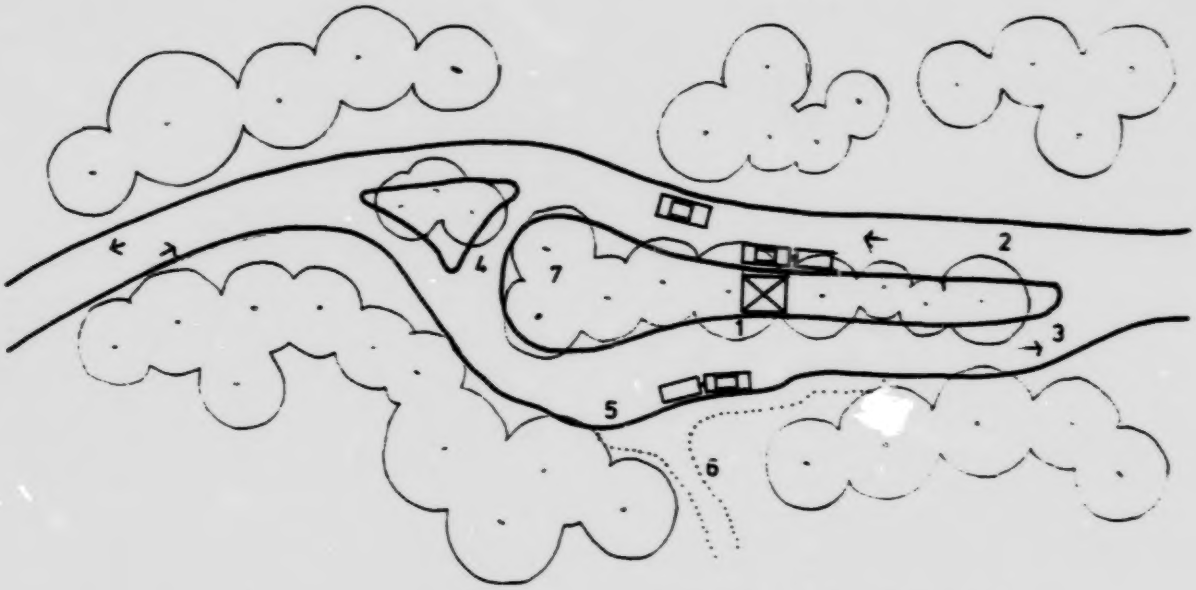


Figure 13.6 - Conceptual Entry Layout

KEY

1. Registration Building
2. Entrance Lanes
3. Exit Lanes
4. Turn-around
5. Parking
6. Service Trail
7. Buffer

- provide parking for visitors and second car at entry station;
- provide a total number of stalls equal to 10% of all the campsites.

13.4 COMPONENTS:

- must provide washrooms and potable water at all campgrounds;
- can be very primitive with pit privy and well water only or fully modern with flush toilets and drinking fountains;
- lighting and electrical receptacles should be provided at all campgrounds, except the primitive campground types, where electricity is usually not included;
- distance to laundry should be 120-180 m.

Table 13.1

Sanitary Facilities/Per User

no. of campsites	no. of toilets m/f	no. of washbasins m/f	no. of urinals	no. of showers m/f
1-10	1/1	1/1	1	1/1
11-25	2/2	2/2	1	1/1
26-35	3/3	2/2	2	2/2
36-50	4/4	2/2	2	2/2
51-75	5/5	3/3	2	2/2
76-100	6/6	4/4	2	3/3
100+	1 additional for every 25 sites			

13.5 CAMPSITE LAYOUT:

- recommend staggering campsites on either side of the road to enhance privacy of each site;
- 450 campsites per campground is a maximum number with one entry control;
- campsites with parking space adjacent may be back-in or pull-through;
- detached campsites are sites with the parking located a short walking distance from the site;
- internal campground roads should be kept at least 61 m from the water's edge;
- there are two major campground layouts, based on vehicular circulation patterns; they are the pinwheel and loop layouts.

1. Access Road
2. Perimeter Road
3. Interior Road
4. Pinwheel

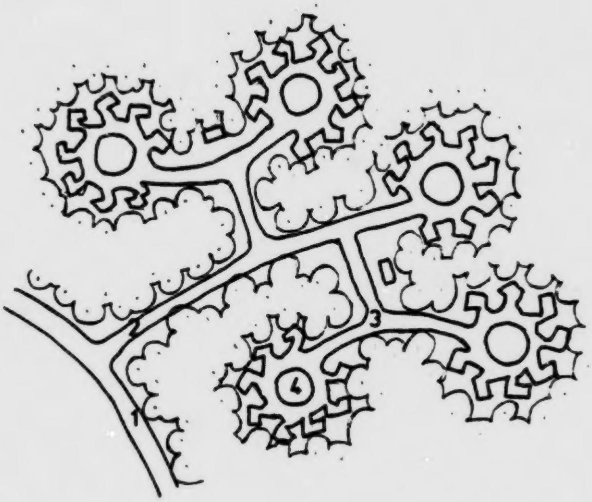


Figure 13.7 - Pinwheel Layout

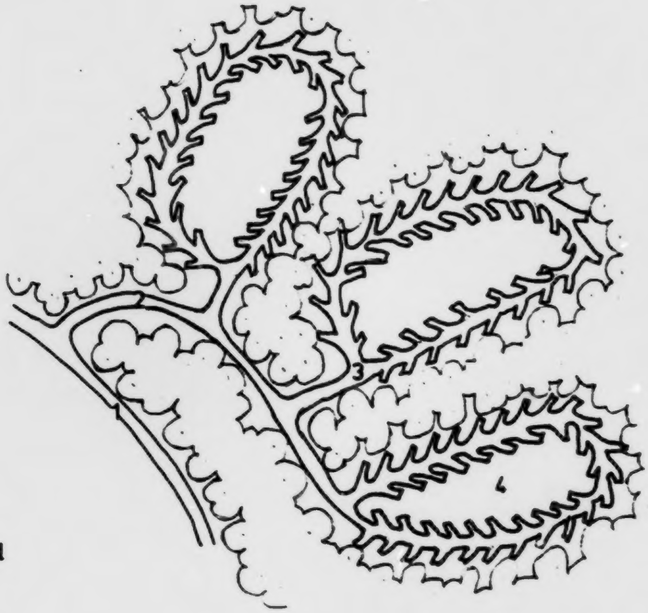
13.6 THE PINWHEEL LAYOUT:

13.6.1 ADVANTAGES OF THE PINWHEEL LAYOUT:

- minimal vehicle traffic passing each campsite;
- maximum flexibility for rotating campsites and closing loops from over-use;
- impact upon the natural environment is clustered into groups rather than distributed over whole site.

13.6.2 DISADVANTAGES OF THE PINWHEEL LAYOUT:

- involves a complex traffic pattern;
- covers a larger surface area.



1. Access Road
2. Perimeter Road
3. Interior Road
4. Loop

Figure 13.8 - Loop Layout

13.7 THE LOOP LAYOUT:

13.7.1 ADVANTAGES OF THE LOOP LAYOUT:

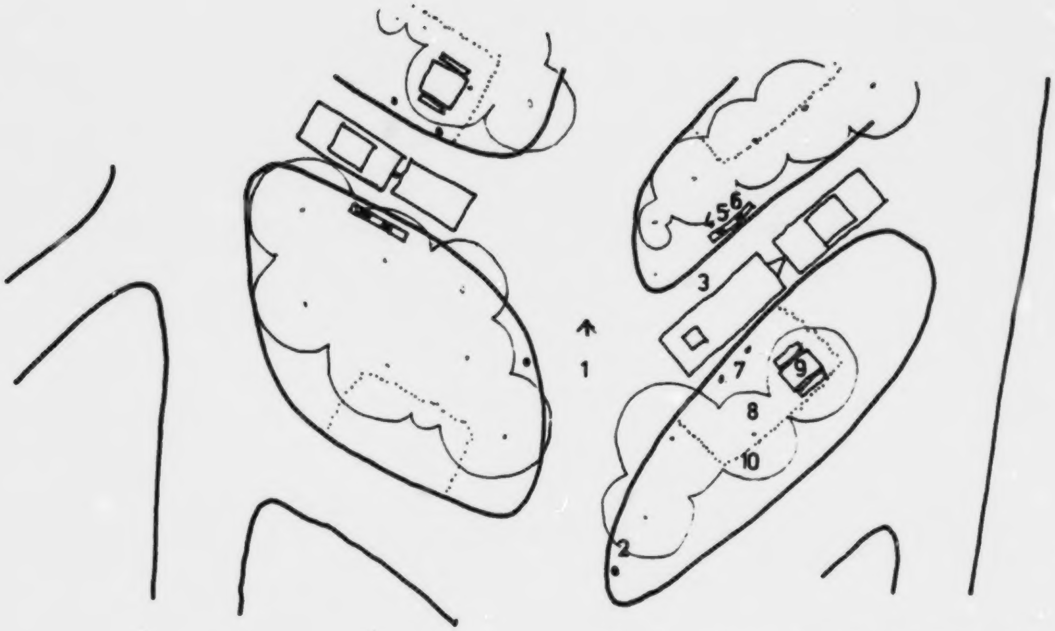
- accommodates different parking arrangements (back-in or pull-through);
- involves a simple traffic pattern.

13.7.2 DISADVANTAGES OF THE LOOP LAYOUT:

- depending on the loop size, there can be considerable vehicular traffic passing each site;
- lowers the chance of privacy for each site, unless heavily buffered or widely separated.

13.8 INDIVIDUAL CAMPSITES:

- provides a "living area" with a tent pad, parking spur, and clearing for cooking and eating, with a fireplace and picnic table;
- all user vehicles should be restricted to the parking spur;
- provide a trash receptacle for every campsite;
- picnic tables can either be permanently fixed, or movable (depending on the situation);
- the area surrounding the picnic table should be gravelled to minimize compaction of the site;
- 10% of all the campsites should be designed to accommodate two or more families;
- the "activity area" of each campsite should also be reinforced with turf grass, leaf litter, bark litter or gravel to prevent deterioration of the site;
- if possible, the campground should provide public facilities, i.e. beaches, boat launching ramps, etc. for its "residents";
- a trailer dump station should be provided on the way out of the campground (see section 16.0) where camping facilities are provided for trailers.


4 5 6
3
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7
9
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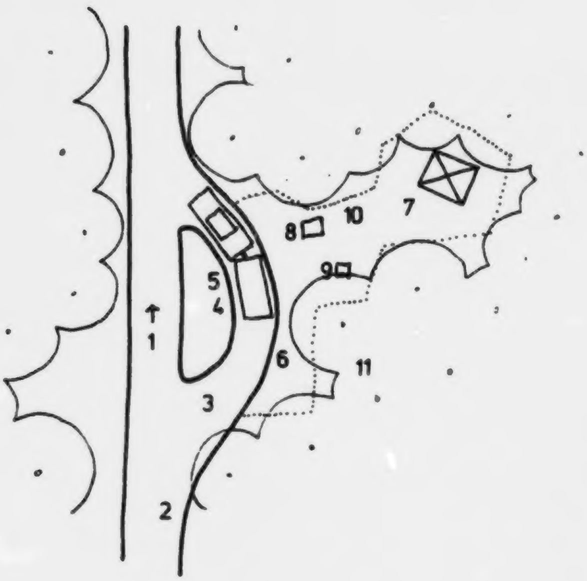
2

Figure 13.9 - One Party Pull-in
Campsite Layout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1
6
11
3
2

Figure 13.10 - One or Two Party
Parallel Campsite

KEY

	FIGURE 13.9	FIGURE 13.10
1.	internal road	internal road
2.	site marker	site marker
3.	pull-through parking spur	parallel parking spur
4.	water hook-up	water hook-up
5.	sewer hook-up	electrical hook-up
6.	electrical hook-up	barrier
7.	barrier	campsite surface (stabilized)
8.	campsite surface	table
9.	table	fire grill
10.	buffer	waste water drain
11.	-	buffer

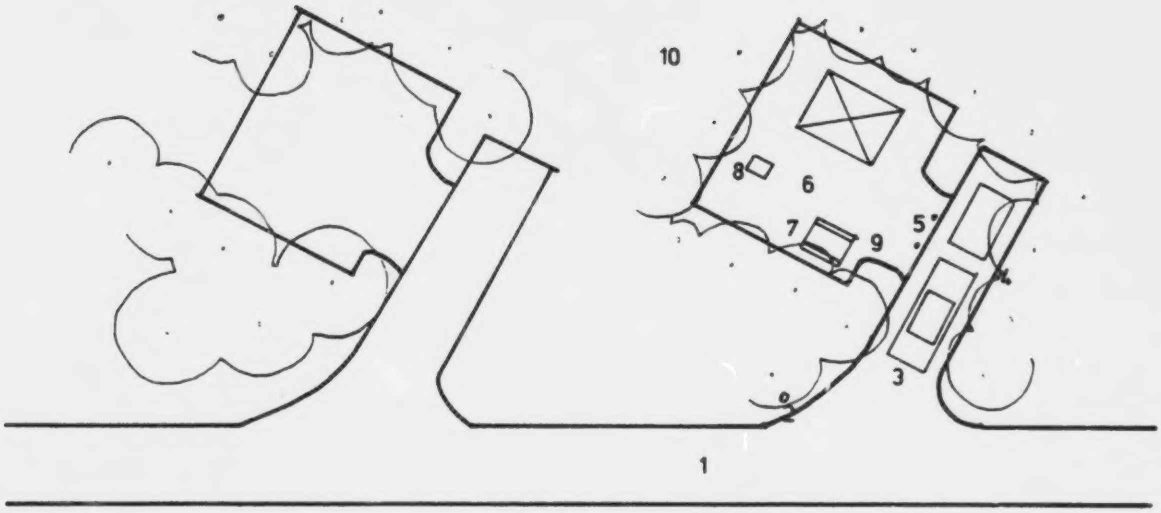

Figure 13.11 - Typical Back-in Layout

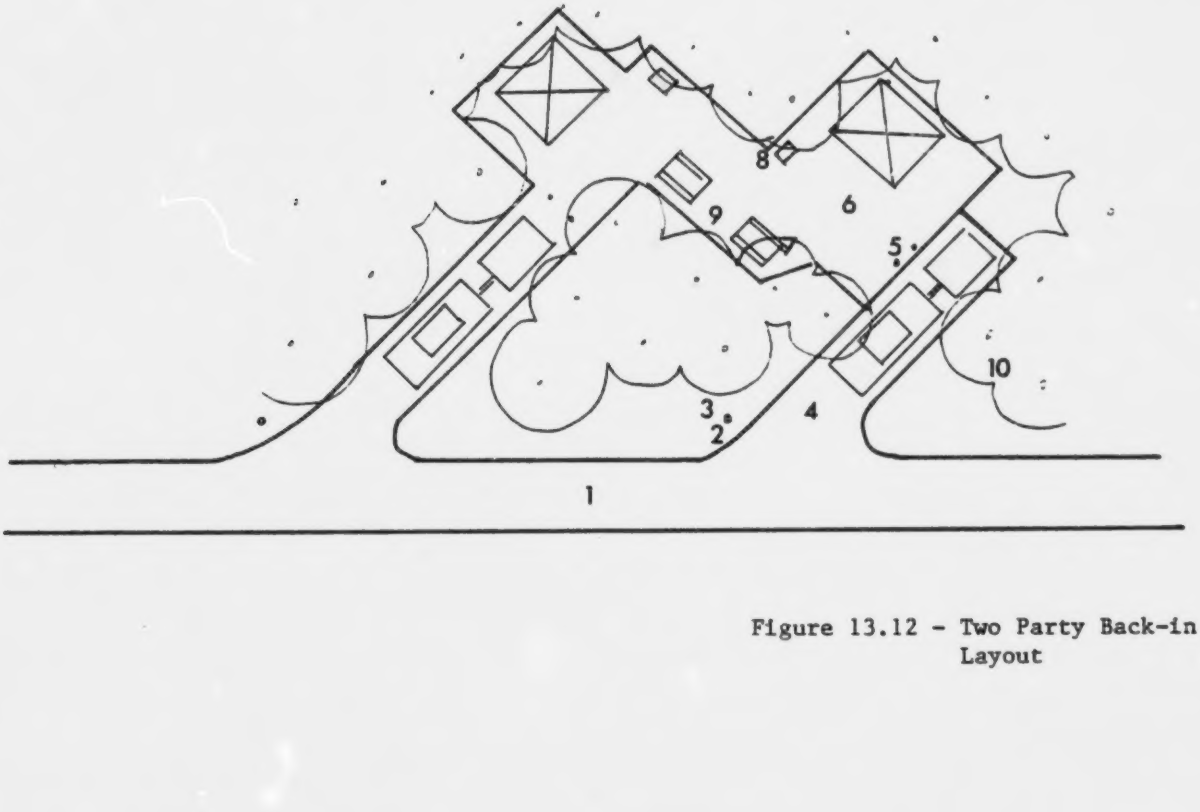
8
9
6
5
10
3
2
4
1

Figure 13.12 - Two Party Back-in Layout

KEY

	FIGURE 13.11	FIGURE 13.12
1.	internal road (one-way)	internal road (one-way)
2.	site marker	site marker
3.	back-in parking spur	garbage receptacle
4.	electrical hook-up	back-in parking spur
5.	barrier	barrier
6.	campsite surface (stabilized)	campsite surface (stabilized)
7.	table	table
8.	fire grill	fire grill
9.	waste water drain	waste water drain
10.	buffer	buffer

13.9 GROUP CAMPSITES:

- are usually removed from other public-use facilities;
- they vary in size, but are all designed to accommodate groups of users at a time;
- recommend designing group sites for 10-80 people;
- should include at each site: tent pads, picnic tables, fire ring, washrooms, drinking water, parking lot, trails to and from facilities, cooking shelter and trash receptacles;
- the minimum recommended size is 2 hectares per group site;
- recommend providing one washroom for each 20 persons of either sex;
- the parking lot should accommodate 15-20 cars and 1 or 2 buses.

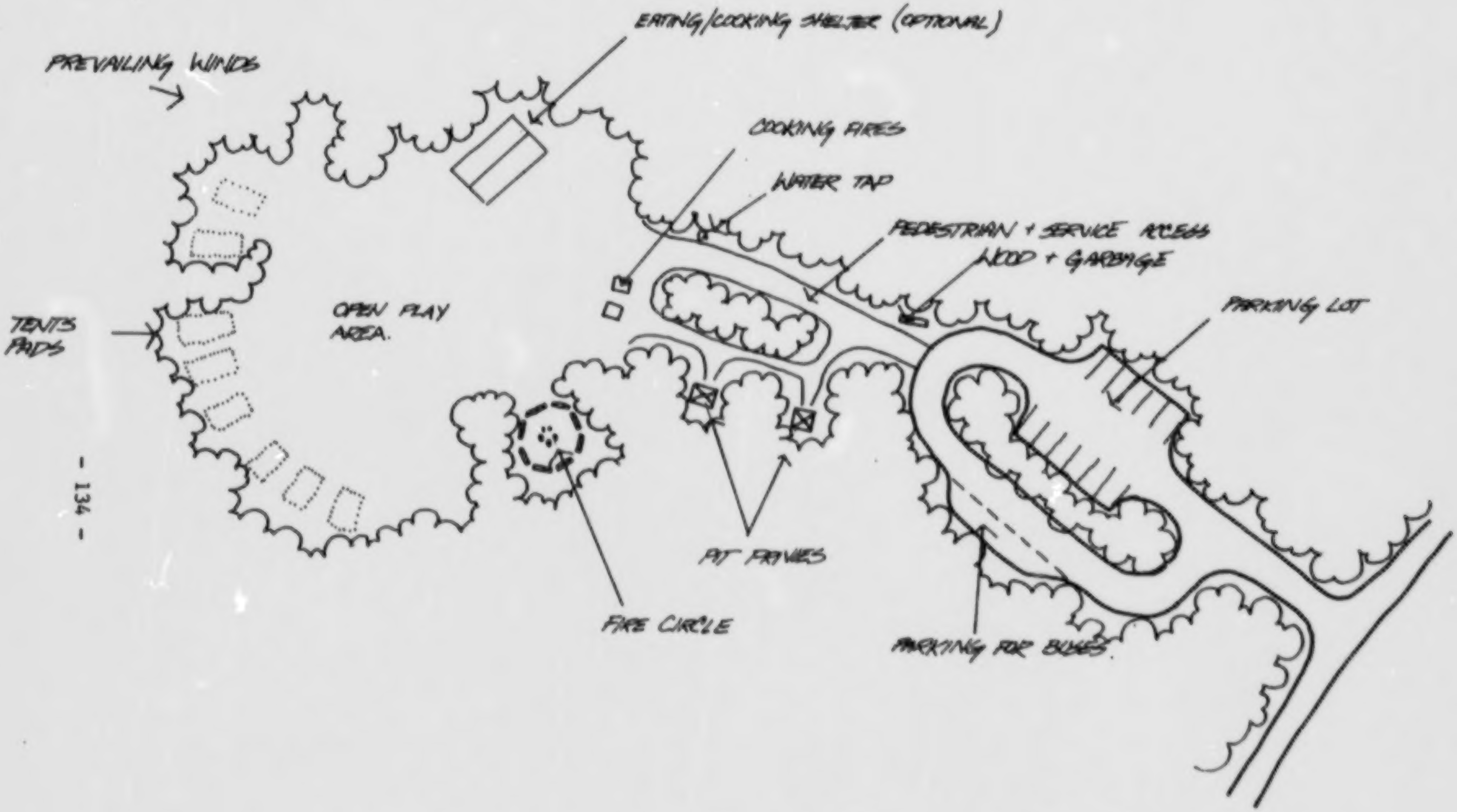
EATING/COOKING SHELTER (OPTIONAL)
PREVAILING WINDS
COOKING FIRES
WATER TAP
PEDESTRIAN + SERVICE ACCESS
WOOD + GARBAGE
PARKING LOT
TENTS PADS
OPEN PLAY AREA.
PIT PRIVIES
FIRE CIRCLE
PARKING FOR BUSES.

Figure 13.13 - Conceptual Group Campsite Layout

13.10 PRIMITIVE CAMPSITES:

- individual campsites should be minimally cleared of vegetation only enough for access, a tent pad, picnic table and living area;
- provide watertight pit or chemical toilets, and potable water, i.e. a well, if water is supplied at all;
- provide a minimum of 30.5 m between sites;
- provide 2 washrooms for every 8 campsites (within 183 m of all campsites);
- for boat-in sites, provide adequate boat tie-up for one or two boats;
- for walk-in sites parking should be provided at some distance from the site;
- these types of campgrounds are often adjacent to hiking or equestrian trails.

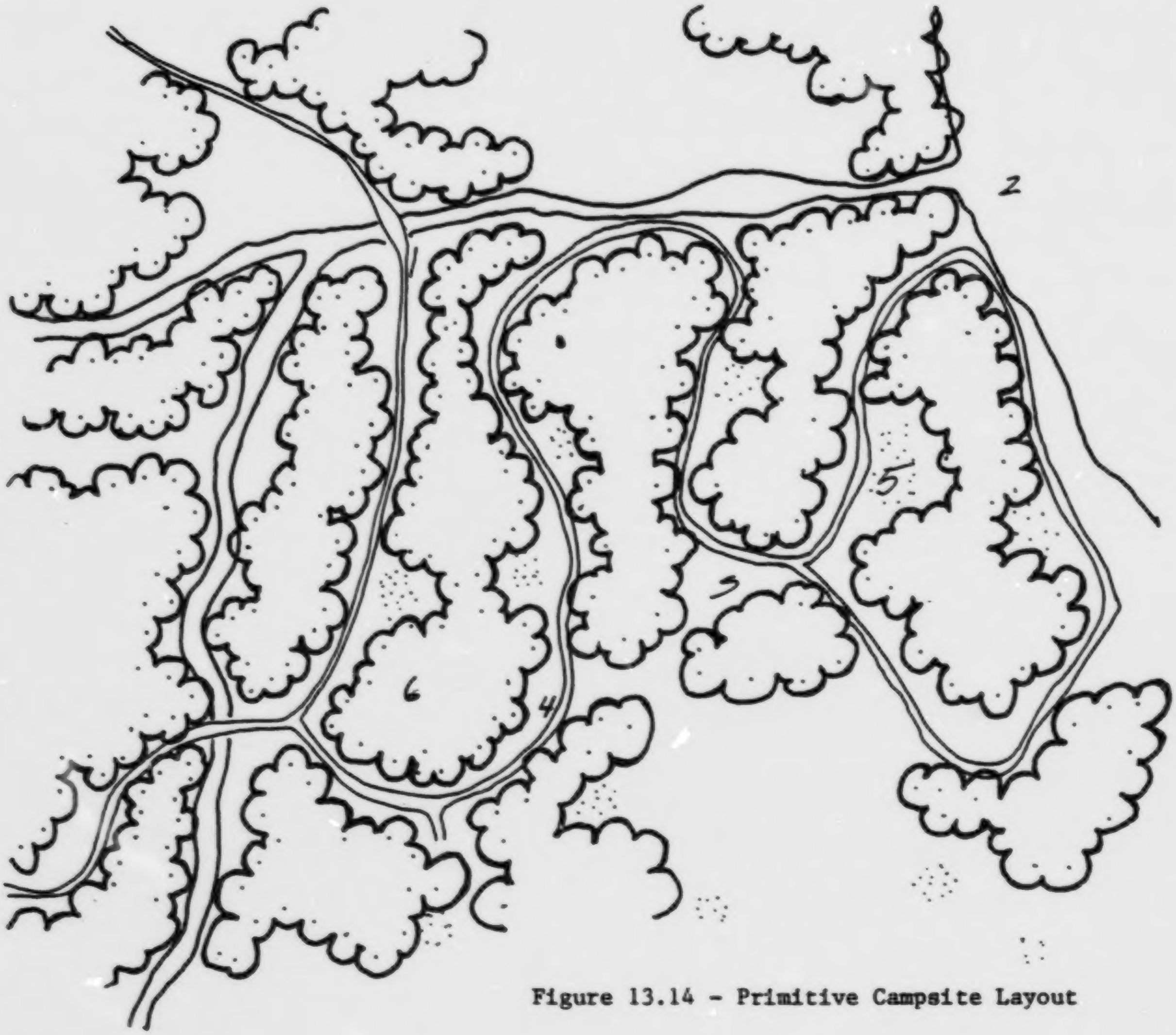

Figure 13.14 - Primitive Campsite Layout

KEY

1. Access Trail
2. Access Waterway
3. Service Building
4. Pedestrian Trail
5. Campsites
6. Buffer

13.11 SELECTED REFERENCES

Bevins, Malcolm. Planning Tomorrow's Campground. n.p.: The Extension Service, Burlington, 1970.

Canada Department of Industry, Trade & Commerce. Planning Canadian Campgrounds. Ottawa: Department of Industry, Trade & Commerce, n.d.

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14. TRAILER VIILLAGES

objective:

to provide an area for seasonal or annual placement of trailers and/or motor homes.

14.0 TRAILER VILLAGES:

- the recommended density per trailer village is 20-25 units per hectare;
- the absolute minimum lot area is 111 m^2 ; recommended minimum is 260 m^2 ;
- recommended trailer lot area is 325-400 m^2 ;
- recommended minimum width of lot is 12 m, recommended minimum length 24 m ;
- recommended minimum frontage of lot abutting an internal road and right-of-way is 12.2 m;
- recommended minimum frontage of lot abutting a cul-de-sac is 6.1 m;
- recommend a maximum of 35%-45% total lot coverage by the trailer unit plus building additions;
- recommend a maximum of 20%-35% lot coverage by the trailer unit only;
- a trailer unit should be located not less than 7.6 m from a park boundary abutting a road, and not less than 4.6 m from other boundaries;
- recommended slope on site is less than 10%;
- trailer units should be at least 6.0 m apart, absolute minimum is 4.5 m (back to back);
- the trailer unit and additions should be less than 7.6 m in height;
- if centralized showers and washrooms are provided, they should be located no further than 183 m from the furthest trailer unit;
- recommend 12.1 m distance between driveways;
- maximum road grade is 12%;
- major roads should be 6.7 m in width with a 15.3 m right-of-way;
- two-way minor road should be 4.9 m in width with a 12.2 m right-of-way;
- one-way minor road should be 4.3 m in width with a 12.2 m right-of-way;

- one-way minor roads should not exceed 152 m in length;
- cul-de-sacs should not exceed 91.4 m in length;
- pathways should be 0.9 m wide;
- the majority of service hook-ups for each unit are to be located on the right side or back, of the back-in parking spurs and on the left side or back for drive-in spur (as the connection is usually made on the driver's side of the vehicle, or at the back);
- all ancillary buildings should be located at least 4.6 m from trailer lots;
- if water is supplied from a well, it should be no further than 30.5 m to the washrooms;
- locate trailers within 45.7-61 m of water tap;
- locate the washrooms a minimum of 15.3 m away from any unit;
- trailer villages containing more than 30 lots should provide a "public-use area" providing boat launching ramps, beaches, play facilities, etc.

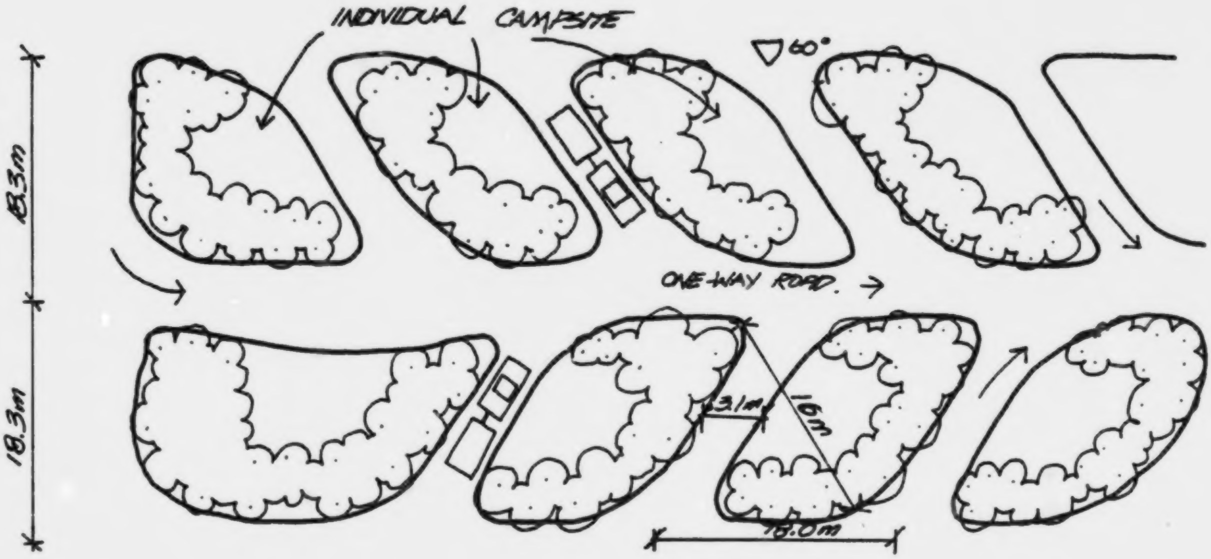
14.1 GENERAL:

- good vehicular access to each unit/lot is necessary;
- can provide either drive-through lots (recommended for seasonal villages) or lots set at 45°-60° angles to the road for ease of access for permanent trailer parks;
- for permanent parks provide complete utility hook-ups;
- all lots should be permanently marked with the lot number;
- all interior roads should be as smooth and free of mud or dust as possible and provide a sound driving surface;
- dead-end streets or cul-de-sacs should have a turning circle at the dead-end with a radius of at least 9.1 m;
- lighting should be provided along interior trails to washrooms, showers, etc., to a level of a 0.3 foot candles;
- if full utility hook-ups are not provided for each unit, then campground must provide central washrooms, hot and cold running water, showers, telephone and trash receptacles for public user.

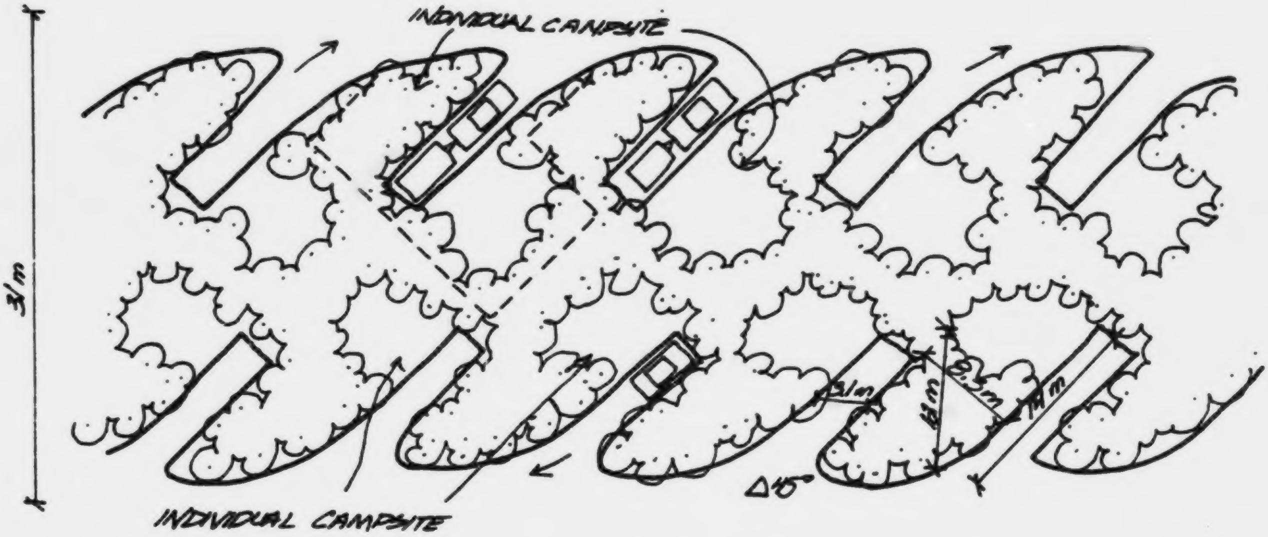
Table 14.1

Services Per Number of Users

no. of trailer lots	toilets m/f	urinals m	washbasins m/f	showers m/f	other
1- 15	1/1	1	1/1	1/1	
16- 30	1/2	1	2/2	1/1	
31- 45	2/2	1	3/3	1/1	1 slop sink
46- 60	2/3	2	4/4	2/2	1 slop sink
61- 80	3/4	2	4/4	2/2	1 slop sink
81-100	3/4	2	5/5	3/3	2 slop sinks
101-130	4/5	2	5/5	3/3	2 slop sinks
131-140	4/5	2	5/5	4/4	2 slop sinks
141-200	4/5	3	5/5	4/4	3 slop sinks

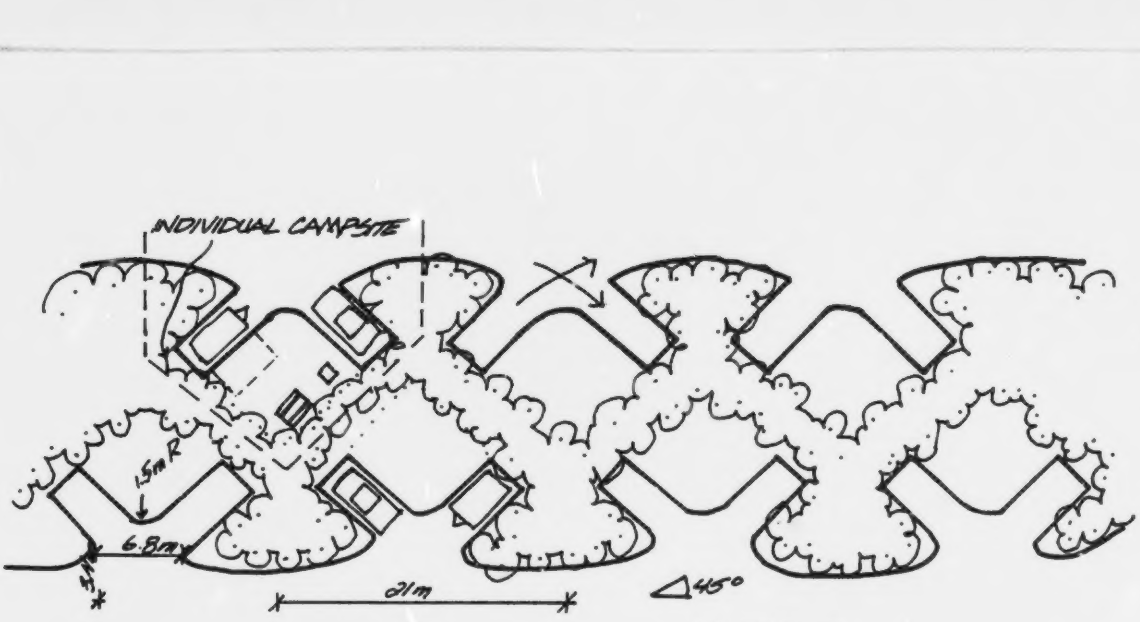

INDIVIDUAL CAMPSITE
▽60°
18.3m
18.3m
ONE-WAY ROAD. →
3.1m
16m
15.0m

PULL-IN LAYOUT


INDIVIDUAL CAMPSITE
31m
3.1m
8m
8.5m
14m
▵45°
INDIVIDUAL CAMPSITE

BACK-IN LAYOUT

Figure 14.1 - Trailer Village Conceptual Layouts


INDIVIDUAL CAMPSITE
1.5m R
6.8m
3m
21m
∆45°

V- LAYOUT

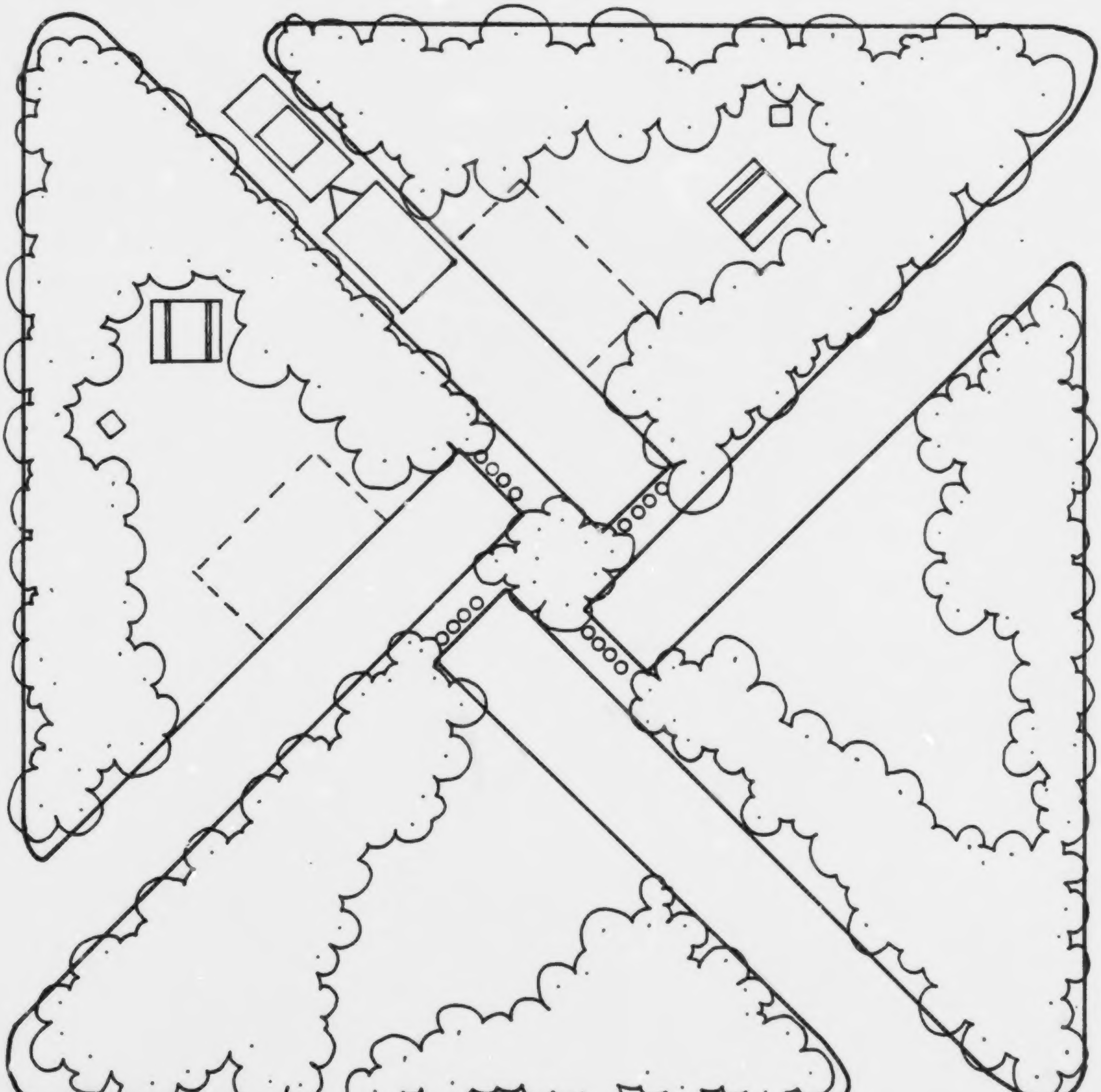


Figure 14.2 - Trailer Village Conceptual Layouts

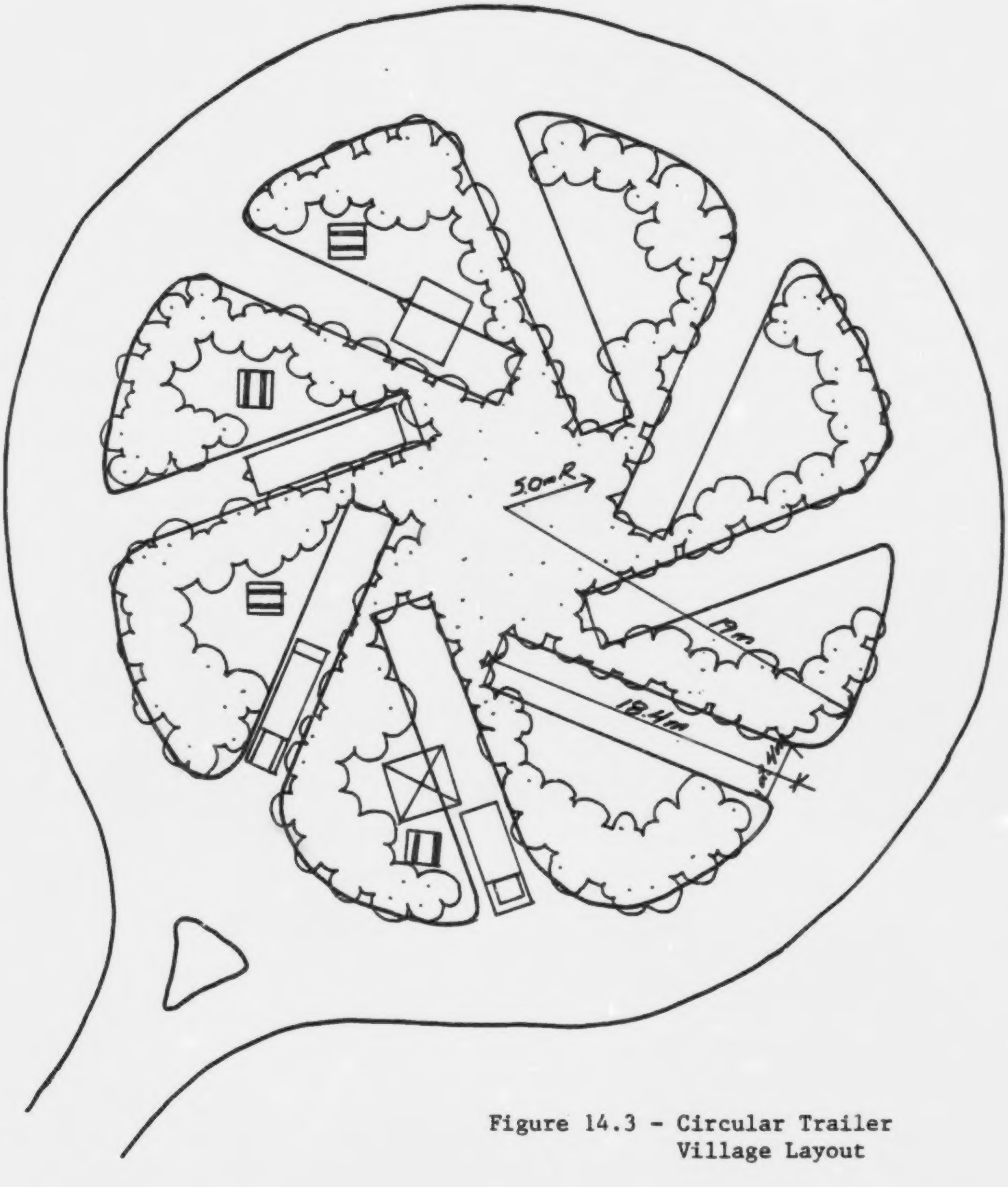

50mR
19m
18.4m
4m

Figure 14.3 - Circular Trailer
Village Layout

14.2 SELECTED REFERENCES:

Canadian Standards Association. Recreational Vehicle Parks. n.p.: Canadian Standards Association, 1972.

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15. TRAILER DUMP STATIONS

objective:

to provide for the dumping and cleaning of sewage holding tanks in recreational vehicles.

15.0 TRAILER DUMP STATIONS:

- pull-off or loop, vehicular layouts are recommended for this activity;
- recommend locating this sewage disposal system between the trailer campground/park and the exit as users can then empty and clean tanks as they are leaving;
- recommend providing 1 trailer dump station for every 100 trailer sites in a campground/park;
- access to the trailer dump station should be via an all-weather access road;
- recommended road width is 4.5 m;
- a one-way pull-off or loop layout is recommended for station;
- the manhole and water tap, etc., should usually be located on the left hand, or driver's side, because the hook-ups from the trailer units are generally on the driver's side of the vehicle (should also provide sufficient turning radii so vehicles with hook-ups on the right hand side of their units can use the station from the "exit";
- trailer dump stations should be located 75.0-185.0 m away from buildings, and 91 m from roadways;
- recommend the provision of vegetative and/or buffers, screens, from other development, roads, etc.;
- the pull-off or loop should be long enough to accommodate two vehicles at a time, recommend 14.0-25.0 m long and 4.6-6.0 m wide;
- must provide operational signs for clean out;
- locate station down wind from other developments;
- recommend the use of a holding tank or septic tank and tile field, located under the station drain.

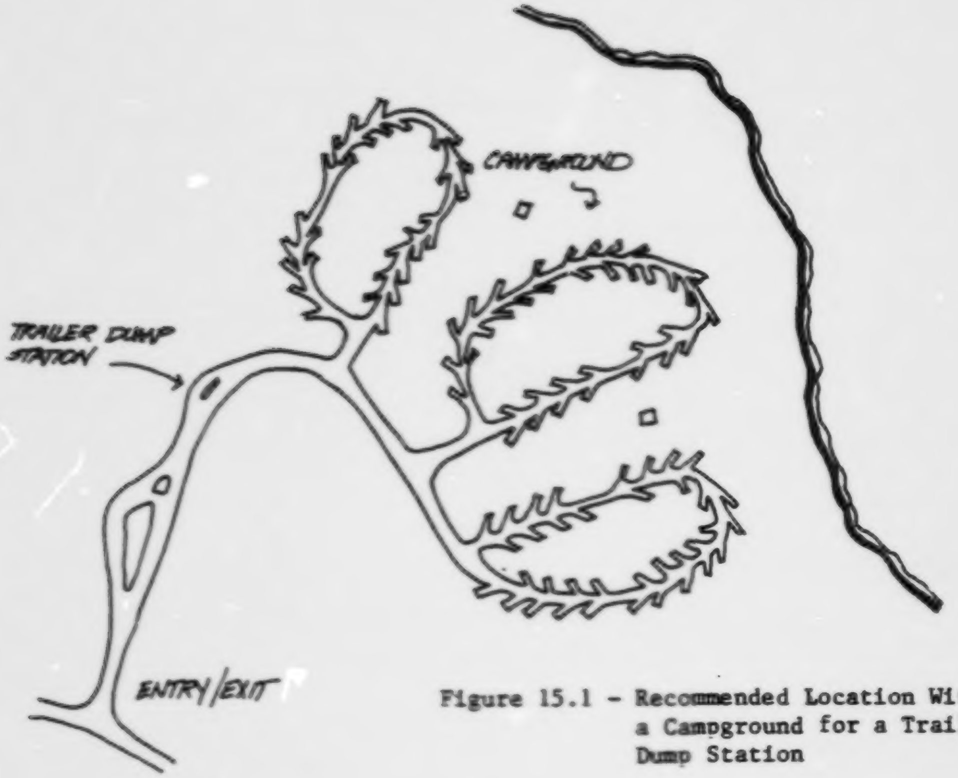

CAMPGROUND
TRAILER DUMP STATION
ENTRY/EXIT

Figure 15.1 - Recommended Location Within a Campground for a Trailer Dump Station

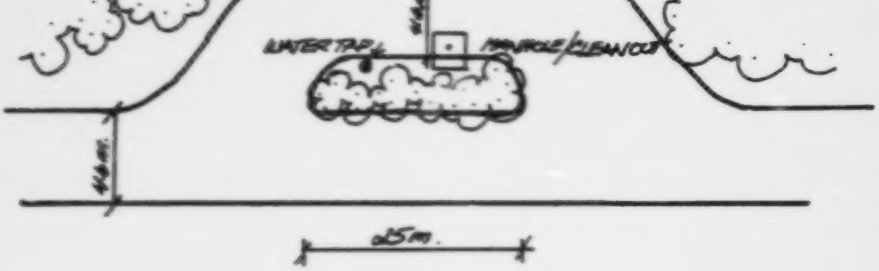
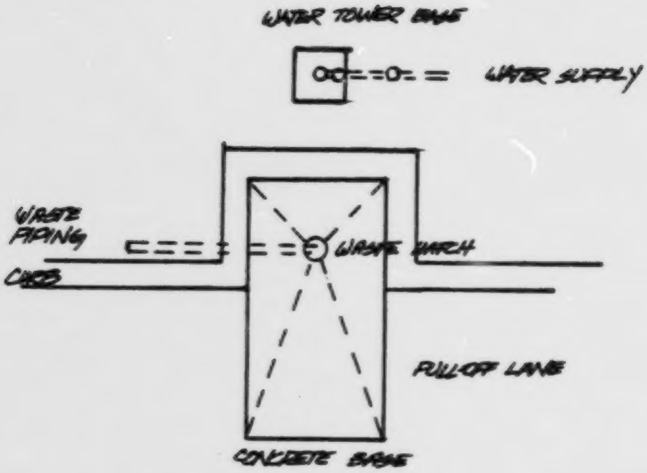

WATER TAP
MANHOLE/CLEANOUT
±25m.

Figure 15.2 - Trailer Dump Station Layout


WATER TOWER BASE
WATER SUPPLY
WASTE PIPING
WASTE BASIN
CURB
PULLOFF LANE
CONCRETE BASE

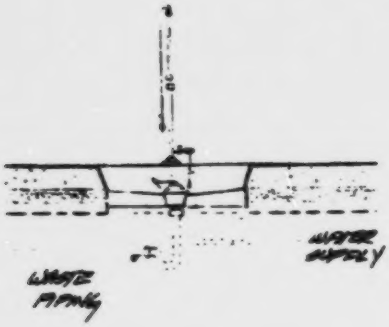

WATER SUPPLY
WASTE PIPING

Figure 15.3 - Manhole and Water Tap Details for Trailer Dump Station

15.1 SELECTED REFERENCES

Department of Indian and Northern Affairs, Parks Canada. Campground Manual. Ottawa: Ministry of Supply and Services, 1977.

16. COTTAGE SUBDIVISIONS

objective:

to provide suitable areas for permanent occupation.

16.0 COTTAGE SUBDIVISIONS:

- it is difficult to standardize all the components that pertain to cottage subdivisions that will adequately cover all the conditions that may exist;
- must provide good access: vehicular, pedestrian, boat-in or fly-in;
- minimum cottage lot size is 1,395 m^2;
- maximum lot coverge by cottage and additional buildings is 10% of the lot;
- individual lot dimension; 31.0 m wide, 46.0 m long;
- the residence must have a floor space of 45.0 m^2 or greater;
- all buildings should be kept at least 8.0 m from the front line of the lot, and as nearly equidistant between the side boundaries;
- public reserve along shoreline, minimum of 8.0 m, but 15.0-31.0 m is recommended (depends on conditions of each site);
- density 3.0-5.0 units per hectare (low-high density);
- two common layout types: linear and cluster;
- linear layouts are the most common shoreline development, but it can be visually unattractive and does not permit public access to the shoreline;
- cluster layouts increase the use of open spaces, provide shoreline linkages to the public, provide a variety of lot designs, but do not allow for individual visual access to the water;
- access should be all-weather, hard surface materials, i.e. gravel, asphalt, etc.;
- if access is walk-in, must provide a central parking area for residents and guests;
- the amount and degree to which cottage subdivisions are serviced are based upon type of development (whether it is year-round or seasonal), the cost of servicing, availability of services, demand, etc.;

- minimum total capacity for holding tanks is 4,500 L.;
- pit privies must be at least 6 m from buildings;
- septic tanks must be at least 1 m from a building;
- septic fields must be at least 6 m from a building;
- roads should be 6 m wide, when provided;
- right-of-way width is 30 m wide, if roads are provided;
- vegetative clearing width for services should be minimal;
- provide public facilities in close proximity, i.e. boat-launching ramp, beach, etc.

16.1 GENERAL:

- the higher the density of cottage lots within a subdivision, the lower the total land and maintenance costs;
- the degree of subdivision development must be based on the capability of the resource base, i.e. the land/water;
- higher densities are suitable in areas that are well-drained, have medium textured soils and are situated in dense mixed-wood vegetation;
- medium densities are suitable in areas that have well-drained to imperfectly drained soils with a course to medium texture and in mixed-wood, aspen or white spruce forests;
- lower densities are suitable in areas that possess some rock outcrops or imperfectly drained soils with coarse-, medium- or fine-textured soils, and situated in mixed-wood, aspen, white spruce or jack pine stands;
- the cluster type of development (rather than linear) is encouraged since it increases the use of the open spaces in separating clusters and provides shoreline linkages to backshore development;
- cluster layout allows for a public reserve strip along the shoreline, walkways, access to the shoreline, centralized dock and boat-house facilities, and the retention of tree cover and the natural character of the shoreline;
- development of a parcel of land should take place in conformance with a general plan of the area in which the parcel is located;
- development should be planned in harmony with the characteristics of the site and the natural character of the shoreline;
- must ensure the availability of potable water, of sufficient volume and purity to meet the users requirements;

- washroom facilities should be located a maximum of 0.2 km from a lot;
- allow for buffers between non-compatible land uses and the subdivision, i.e. industrial development, waste disposal site;
- the cottage subdivision should be located relatively close to other settlements and services such as a town, service centre or active recreational areas;
- the cottage subdivision should be located within 240 km of a major urban centre, or at a particularly attractive area that may draw cottagers from a greater distance;
- cottage subdivisions should be made accessible in winter;
- recognize and avoid development which could endanger the lives or property of residents, e.g. buildings in flood plains or near escarpment edges;
- cottages should be well designed and well-kept, and colour schemes should blend with the natural surroundings.

16.2 SELECTED REFERENCES

Douglass, Robert W. Forest Recreation. New York: Pergamon Press Inc., 1975.

Fogg, George E. Park Planning Guidelines. n.p.: The National Society For Park Resources, 1975.

Hadikin, Les. "Park Planning Guidelines". Unpublished. Manitoba: Department of Natural Resources, n.d.

Manitoba Department of Municipal Affairs, Municipal Planning Branch. Shoreline Recreation: An Environmental Approach to Development. Winnipeg: Queen's Printer, 1976.

17. HYDRO'S RIGHTS-OF-WAY

objective:

to provide the potential to use the cleared areas associated with electrical installations, as part of the recreational experience.

17.0 HYDRO RIGHTS-OF-WAY:

- on newer hydro installations, the overhead clearance required is 6.4 m to allow for a 0.9 m sag of the wires;
- parking and roads require a vertical clearance of 5.5 m minimum for the lowest wire under extreme conditions;
- 3.0 m minimum horizontal distance from a structure is required from the wire location to the ground;
- pedestrian areas (including playgrounds) require 4.2 m vertical clearance, with 5.2 m under newer installations;
- plantings close to hydro lines should not exceed 3.6 m in height;
- width of right-of-way is 4.5-5.0 m for individual power lines and transmission lines respectively;
- the recreational use of rights-of-way is unlimited except for residential use, e.g. bus shelters, garden plots, trails, cultivation etc., are acceptable;
- hydro rights-of-way are useful; accommodate segments of trails, since the clearing has already been completed, this reduces the overall environmental impact upon an area, although the aesthetics of this layout are questionable.

17.1 GENERAL:

- suitable activities that could be fully or partially accommodated within right-of-way clearings are agricultural cultivation, segments of trails, since it is not recommended to locate the entire trail in a clearing, warming huts, etc.;
- serves as an excellent corridor due to its layout;
- the significance of utilities as an integral and indispensable part of every park cannot be overemphasized, especially in light of the current ecological and environmental consciousness;
- if possible, hydro lines should be placed underground for a positive aesthetic quality, but this depends on site conditions and the cost (far too costly in areas of rock, peat, marsh, etc.);
- to install a single hydro pole costs approximately $1,000 minimum, usually 20 poles per kilometre;
- above-ground hydro installations cost between $20,625 and $62,500 per kilometre to install (Manitoba Hydro cost estimate);
- below-ground hydro installations start at $56,250 per kilometre (Manitoba Hydro cost estimate);
- if possible, electrical and telephone lines should be installed together, to avoid duplication of costs;
- with overhead power-lines it is imperative that special care be taken to break up long views along the right-of-way.

17.2 SELECTED REFERENCES

Manitoba Hydro, 820 Taylor, Winnipeg, Manitoba, 474-3311.

18. TOBOGGAN SLIDES

objective:

to provide an area with adequate site characteristics and with the necessary facilities to allow people to toboggan.

18.0 TOBOGGAN SLIDES:

- the toboggan slide should be a minimum of 300 m in length, with 609 m being a more desirable length;
- these overall lengths include the launching ramp, the run or slide, and a run-out area at the bottom of the hill;
- general dimensions of a toboggan slide: 9.0 m high tower, 36.0 m long ramp, 473 m long run/slide, with a 15.0 m drop;
- the slide should be 0.6-0.9 m wide with two rails on either side, 130 mm high and 0.5 m apart;
- the slope for a toboggan slide should be 10%-40%, with 30% recommended;
- the run-out area at the end of the slide should have a 5%-10% slope;
- a north - north-eastern orientation is recommended;
- west-facing orientation more desirable but the sun tends to thaw the ice, thus reducing the length of the slides usable season.

18.1 GENERAL:

- toboggan slides should be developed in conjunction with other winter activities, so public facilities need not be duplicated;
- for example, the toboggan launching tower could be used as an observation tower in the summer, or for a go-cart launch, etc.;
- toboggan slides should be included in parks up to one hour's drive from major urban areas;
- the toboggan slide can either be on natural slopes, be man-made, or a combination of both types;
- a toboggan slide requires a fairly steep initial slope to gather speed for a long, fast and exciting ride;
- if using a gentle natural slope, it is often advisable to construct a launch platform at the top of the hill to gain extra height which is needed to increase the speed and length of the run;
- the slide should be kept as smooth as possible to increase speeds and maintain safe conditions;
- avoid natural slopes that are susceptible to erosion or excessive frost heaving.

18.2 THE SLIDE:

- an average toboggan is 0.6–0.9 m wide, 0.9–3.0 m long;
- toboggan speeds up to 80 km are common and acceptable on a slide;
- the slide should have a controlled launching system, i.e. teeter-totter device (operator loads toboggan onto launch and when ready pulls lever to tip the launch, sending the toboggan and users down the slide);
- control the use to ensure a safe experience;
- the launching tower can be constructed of steel or wood members;

- the slide itself should have a concrete foundation (similar in construction to a sidewalk);
- refrigeration pipes (on man-made slides) should be used to keep the surface iced, and are placed between the guard rails of the slide;
- once the ice is in place, there should be 51.0 mm of guard rail exposed (approximately 76.0 mm of ice thickness);
- this guides the movement of the toboggan on the slide;
- it is necessary to have adequate water supply close to site of the toboggan slide so it is convenient to ice the run (2 or 3 times annually);
- since toboggans may be travelling up to 80 km per hour, it is important to restrict access to the slide and run-out area to pedestrians by the use of fencing, etc.;
- on site, provide ample parking, with lighting for night shelter, and lighting for toboggan slide and area;
- if planting is to be part of the design, use coniferous plant material to provide wind protection, and to act as a snow fence.

18.3 SELECTED REFERENCES

Buermeyer, J. "Proposed Toboggan Slide in Spruce Woods Provincial Park". "unpublished". Manitoba: Department of Natural Resources, Engineering & Construction Branch, 1981.

Fogg, George E. Park Planning Guidelines. New York: National Society for Park Resources, 1975.

19. SKI SLOPES

objective:

to provide areas for recreational downhill skiing.

19.0 SKI SLOPES:

- recommended ski slope for beginners is up to 10%;
- recommended ski slope for advanced skiers is 10%-20%;
- recommended ski slope for expert skiers can be greater than 20%;
- slope must have a minimum snow cover of 112 mm.

19.1 GENERAL:

- basic requirements for a ski slope are slopes, natural or man-made, gently rolling to steep, some elevation (to provide sufficient length), snow and support facilities;
- skiing in Manitoba is limited due to lack of high elevations (130-150 m above sea level serve as ski slopes today);
- the development of ski slopes is dependent on existing conditions (can develop virtually any area, provided it has snow, slope and elevation);
- the rockier and bumpier the terrain, the greater the need for snow to smooth to a usable state;
- uncluttered summer pasture lands on hills are ideal for developing into ski slopes, because they are initially free of vegetation;
- retain or provide vegetation (primarily coniferous) on either side of ski runs to provide some wind protection for skiers;
- north-facing slopes are poor for skiing since they receive little sun and are, therefore, unpleasant on bitterly cold days, but they do keep their snow cover longer since they are not facing the sun; following periods of thaw, though, ice may persist until there is a fresh snowfall;
- south-facing slopes are better for skiing because they are warmed by the sun; but this proves to be a problem too, since powery conditions are short-lived and snow often become crusty; south slopes lose their snow early in spring;
- east- and west-facing slopes are warmer than north-facing slopes and snow lasts longer than on southern slopes (compromise between northern and southern slopes).

19.2 COMPONENTS:

- access to ski hill should be direct, safe and well maintained;
- 7.6 m wide gravel road sufficient to allow two cars to pass;
- provide lighted parking lot close to main shelter/ chalet;
- chalet should include changing area/warm-up area, rentals, washrooms, lunch room or restaurant, first aid station and, possibly, overnight accommodation;
- extent of chalet and the facilities it provides is dependent upon demand;
- variety of methods of getting to top of the slope, e.g. climb, or rope tow, T-bar lift, chair lift or gondola;
- in Manitoba, due to short length and height of slope it is most economical to provide a T-bar lift or rope tow;
- hills should be groomed and maintained in order to keep them in top form, i.e. with the use of snow-making machinery, etc.

19.3 SELECTED REFERENCES

Fogg, George E. Park Planning Guidelines. n.p.: National Society for Park Resources, 1975.

20. SKATING RINKS

objective:

to provide an indoor or outdoor, natural or man-made iced area, available for use by recreational skaters.

20.0 SKATING:

- recommend a minimum of 0.3 hectares for an outdoor skating rink;
- no maximum size limit (e.g. Rideau Canal, Ottawa);
- skating rinks are commonly 25-40 m wide, 110 m long;
- they are usually designed in figure 8's or a more elaborate design to increase interest (use of islands); widen and narrow iced areas for interest;
- water must freeze to at least 102 mm thickness for safe skating;
- skaters want 1/2 - 1 hr. maximum on the ice, outdoors in Manitoba;
- hockey rink is 28.0 m x 61 m (average size);
- separate skating and other activities such as hockey/ broomball.

20.1 GENERAL:

- to provide a skating area, one can either construct a rink or use a natural pond, lake or stream, or simply clear a flat area of frozen ground and freeze layers of water on it to create a suitable surface for skating;
- most rinks have a natural surface rather than concrete, because outdoors there are few programs which require a concrete surface in the summer, and for those that do, asphalt surfaces are used, but asphalt cannot be used for a base for a skating surface as they absorb heat from the sun and this will melt the ice;
- site the rink where the natural drainage system is adequate to ensure the driest possible surface to begin flooding when winter arrives;
- a dry surface is essential for the base, otherwise frost from the ground will heave the skating surface causing cracks in the surface;
- where natural drainage is not sufficient, use weeping tiles under the rink's surface;
- these should be laid 7.6 m apart, with collecting pipes taking the run-off to some means of drainage, either sump hole or sewer;
- 101 mm tile pipes should be laid in trenches 6-7.6 m apart, after a plastic sheet has been laid down;
- the piping should be laid with a drop of 25 mm per 3 m;
- the pipes should be covered with coarse, crushed rock to level the trench, and the entire rink area should be leveled with 50-101 mm of sand;
- if it is too expensive to include a drainage system, pour a layer of sand to a level of 101 mm; this will help retain soil moisture and stop it from rising, freezing and cracking the ice layer;

- important to freeze layers of water onto the base in stages;
- skating and hockey rinks especially should be mounted on a continuous concrete sill or footing, laid on the perimeter of the rink;
- as an alternative, spot footings can be used at intervals of 3 m (as base for the studs);
- the studs should be bolted to the base instead of being set into it, so as to allow replacement at required intervals; the rink boards can then be nailed to the studs;
- snow banks, banked around the edge of the rink, also provide some protection from the wind.

20.2 NATURAL RINKS:

- can use either man-made or natural ponds, lakes, streams;
- size is variable;
- could be large enough to allow hundreds of skaters on the iced surface at one time or it could be backyard size for family use;
- should be located in sheltered, sunny areas so that the skating experience is as pleasant as possible;
- recommend planting heavily around the edges of the skating area to provide wind protection also;
- if provided, outdoor benches should be of wood as they are warmer than concrete or metal ones.

20.3 OTHER:

- the recommended method of flooding for a skating rink is to spray water through a nozzle in small amounts so that it freezes on the surface and is built up slowly, in layers;
- the provision of areas to skate on should be considered whenever water is available, and safe ice conditions can be expected with seasonal regularity;

- the skating rink should be provided with lighting for night use;
- also provide a warming shelter/change house, with washrooms, drinking water and a place to change into skating gear;
- provide an adequate parking area for the skaters' use;
- designate separate areas for recreational skaters, and more active ice sports such as hockey to maintain safety for the user;
- anything constructed of metal should not be exposed at winter activities sites;
- provide rubber mats where hard surfaces or concrete is crossed to protect the skates' blades.

20.4 SELECTED REFERENCES

Carpenter, Jot. D. ed. *Handbook of Landscape Architectural Construction*. New York: The Landscape Architecture Foundation Inc., 1976.

Fogg, George E. *Park Planning Guidelines*. n.p.: The National Society for Park Resources, 1975.

21. ROADS

objective:

to provide adequate vehicular access to facilities and services in Provincial Parks.

Table 21.1

	service fire access	campground internal	perimeter	rural minor access	major access	parkway	local	collector	arterial	urban local	collector	arterial
Design Speed km/hr.	50-80	NA	50	40	60	50-60	50-80	60-100	80-100	50	50	60
Minimum Radius or Curve (m)	80-230	18	80	50	120	80-120	80-230	120-380	230-380	90	90	120
Maximum Grade (%)	7-12%	5	5	10	7	10	7-8	5-7	5-6	8	8	7
Width of Travelled Way	5-6 no turnouts	4.5	1-way 4.5m 2-way 6.5m	6.5	7.5	6.5	6.5	7.5	7.5	6	7.5	15
Shoulder Width (m)	1.25	.5	.5	1.25	1.75	.5-1.1	1.0-7.5	1.25 2.5	2.5	-	-	-
Rounding (m)	-	-	-	-	.5	-	0-.25	.25-.5	.5-1.0	-	-	-
Stopping Sight Distance (m)	65-140	NA	65	45	85	65-85	65-140	85-200	140-200	-	-	-
Passing Sight Distance (m)	340-560	NA	340	NA	420	340-420	420-560	420-680	560-680	-	-	-
Parking Lane Width (m)	-	-	-	-	-	-	-	-	-	2.5	3-6	-

Source: Parks Canada Road Classification System & Geometric Design Standards. 1981.

21.1 GENERAL:

- there are 3 categories of roads within the park system;
- they are: service roads (including fire roads, internal and perimeter campground roads), rural roads (including minor and major access, parkways, local collector and arterial roads) and urban roads (including local, collector and arterial roads).

21.1.1 SERVICE ROADS:

- provide access to borrow pits, garbage dumps, and water supply facilities, and are not intended for heavy public use;
- average speeds 25-55 km/hr.;
- design should provide for shallow cuts and fills, minimal rights-of-way and a gravel surface.

21.1.2 FIRE ROADS:

- are used by the ranger service and provide occasional or emergency access to isolated areas;
- are used primarily by trucks operating up to 25 km/hr.;
- design to minimum standards that meet the anticipated requirements for access which may be seasonal or year-round;
- the surface material can be native soils or gravel;
- avoid heavy cuts and fills.

21.1.3 INTERNAL CAMPGROUND ROADS:

- roads provide circulation and dispersal of individuals to their campsites;
- the roads carry a variety of vehicles from cars, to trailers, to camper-trucks, and maintenance vehicles, at speeds up to 25 km/hr.;
- one way traffic circulation is recommended;

- recommend a bituminous surface, but gravel is sufficient if treated to control dust.

21.1.4 PERIMETER CAMPGROUND ROADS:

- connect individual clusters of campsites and have the same use as internal campground roads;
- gravel or bituminous surface materials are recommended.

21.1.5 RURAL ACCESS ROADS:

- provide access to a specific facility or area;
- they are used by a variety of vehicles at average speeds of 30-70 km/hr.;
- usually only seasonal use;
- consider scenic and aesthetic features when locating this type of road;
- must provide for safe public use;
- surface material varies with use.

21.1.6 PARKWAYS/SPECIAL-USE ROADS:

- parkways or special-use roads are specifically designed to provide pleasant driving, through aesthetically pleasing locations and attractive roadside developments;
- parking areas, lookouts and lay-bys should be developed in designated areas to allow people to stop and get out of their vehicle;
- important that this road blend into the landscape.

21.1.7 LOCAL RURAL ROADS:

- provide unlimited access to the adjacent environment, through one or more developed areas for all types of vehicles moving at speeds of 50-70 km/hr.;
- use is light to medium;
- collector roads (rural) connect local and arterial roads;

- use is light to medium at speeds of 55-70 km/hr.;
- arterial roads (rural) join major developments and connect with local and collector roads;
- use is medium to heavy, at speeds of 65-80 km/hr.;
- intersecting roads have to be controlled.

21.1.8 URBAN LOCAL ROADS:

- provide access to all adjacent property;
- the majority of traffic has its origins or destinations along this length of the road;
- generally, this road does not carry large volumes of traffic other than to adjoining streets;
- collector roads (urban) provide access and traffic service from, and distribute to local streets;
- arterial roads (urban) carry large volumes of traffic of all types at medium to high speeds;
- serve to connect local and collector streets to rural roads.

21.2 AESTHETIC CONSIDERATIONS:

- an aesthetically pleasing road is one that lies lightly on the land;
- in most cases should avoid heavy cuts and fills as it is disruptive to the surrounding landscape;
- attempt to mould roads to the terrain;
- avoid long tangents by changing elevations, developing view-points, heavy planting, etc.;
- provide axial alignment with focal points;
- roads do not have to be twisting and turning to heighten interest;
- avoid abrupt changes in alignment;
- allow for a curvilinear tree line, to appear more natural and more interesting to the eye;
- allow the tree canopy to shade the road at chosen spots;
- consider shrub growth along some roads;

- control tree regeneration through a continuing maintenance program.

21.3 DESIGN SPEED:

- is a speed selected for purposes of design and correlation of the geometric features of a highway, and is a measure of the quality of service offered by the highway;
- it is the highest continuous speed at which individual vehicles can travel with safety, upon a highway when weather conditions are favourable, traffic density is low, and the geometric design features of the road are the governing conditions for safe speed (see Table 21.1).

21.4 SIGNING:

- roadside signing whether regulatory, informational, or interpretative is an intergral part of the visitors' experience;
- necessary to ensure that the quality and design of all signing enhances the vistors' experience;
- recommend a minimum of 106 m of unobstructed viewing distance between a sign and the vehicle;
- warning signs for motorists must be placed at a minimum of 46 m and a maximum of 305 m in advance of a hazard;
- they should be positioned vertically plumb and at an angle of 93° to the direction of traffic flow.

21.5 SURFACE MATERIAL:

- the surface should be adequate to support the intended use;
- should recommend an all-weather, smooth, firm surface (e.g. gravel);
- the material selected depends on the volume and type of traffic;

- where use is very heavy, asphalt or concrete are recommended (150-225 mm thick with gravel base 500-1,200 mm thick);
- where weights on roads are lighter but roads are heavily used recommend a surface material thickness of 100 mm and subgrade 150 mm.

21.6 OTHER:

- one-way roads require a 2% slope for sheet drainage;
- two-way roads are usually crowned with a 2% slope;
- maximum superelevation for major roads is 0.08;
- maximum superelevation for minor roads is 0.06;
- clearing widths (rights-of-way) should vary according to each particular site condition;
- no clearing widths required for 16-32 km/hr.; 3 m required for 48 km/hr.; 6 m required for 64 km/hr.;
- embankment slopes of 1:4 to a height of 7.6 m is recommended;
- camber slopes for ditches recommend 1:30 or 1:40 slope;
- the minimum side slope of a ditch must be 1:4 to avoid erosion problems;
- minimum of 7.6 m from ditch to shoulder;
- preserve natural ground covers on slopes;
- construct drainage culverts with a break in the grade so that the outlet has a velocity within an allowable limit;
- provide drop structures if necessary to dissipate energy at entrances or outlets of culverts;
- use concrete paving, rubble, or rip-rap slopes at bridge abutments to stabilize slopes.

21.7 COMPONENTS:

- provide waysides at convenient distances, with washrooms, telephone, picnic area and trash receptacles;
- these are often provided by private enterprises that develop along roadsides (gas, water, first aid and emergency information, overnight accommodation, etc.), are usually available;
- access control should be provided on appropriate roads, i.e. campground, park entrances, etc., which regulates traffic and provides information to the visitor.

TABLE 21.2

DIMENSIONS (m) OF MOTOR VEHICLES

Vehicle Type	Symbol	Overall Length	Wheel Base	Front Overhang	Rear Overhang	Overall Width	Minimum Turning Radius	Minimum Inside Radius
Passenger Car	P	5.7	3.3	0.9	1.5	2.1	7.3	4.6
Motor Home	MH	9.1	6.0	1.2	1.8	2.4	13.0	8.6
Car/Travel Trailer	P/T	15.0	11.0	0.9	3.0	2.4	7.3	1.6
Car/Boat Trailer	P/B	12.8	9.4	0.9	2.4	2.4	7.3	3.0

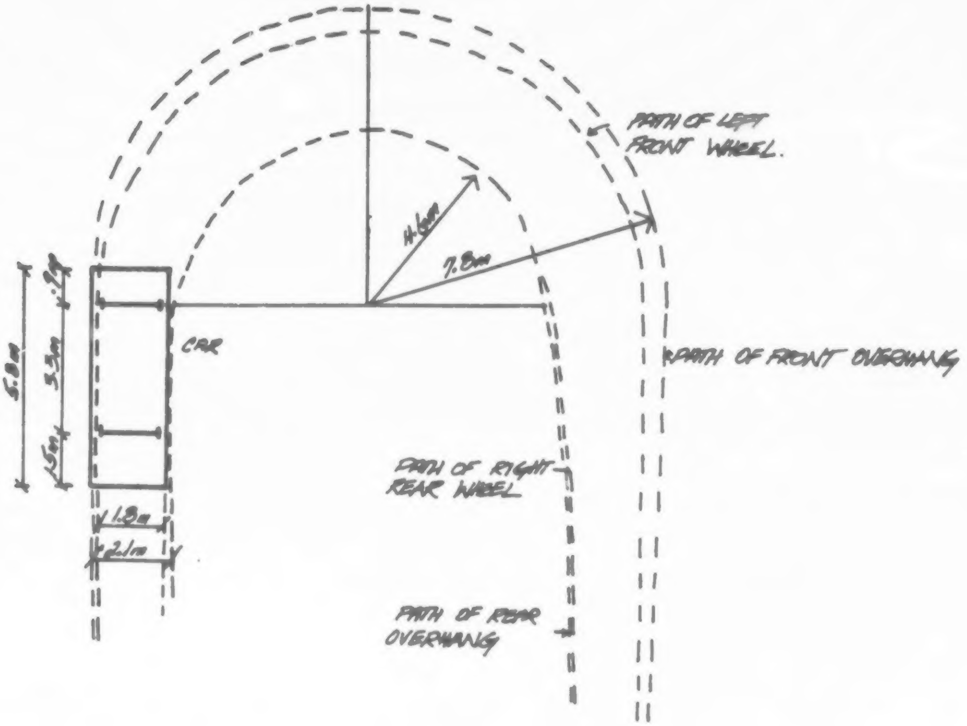

PATH OF LEFT FRONT WHEEL.
4.6m
7.8m
PATH OF FRONT OVERHANG
CAR
5.8m
3.3m
.9m
1.5m
1.8m
2.1m
PATH OF RIGHT REAR WHEEL
PATH OF REAR OVERHANG

Figure 21.1 - Minimum Turning Path for Typical Car

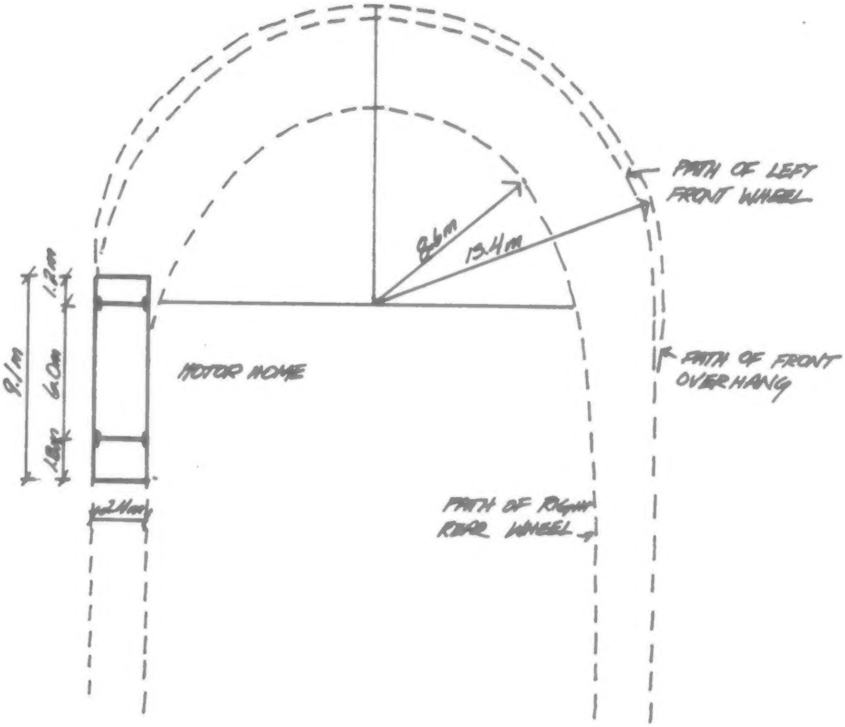

PATH OF LEFT FRONT WHEEL
8.6m
13.4m
1.2m
9.1m
6.0m
1.8m
MOTOR HOME
PATH OF FRONT OVERHANG
2.4m
PATH OF RIGHT REAR WHEEL

Figure 21.2 - Minimum Turning Path for Typical Motorhome

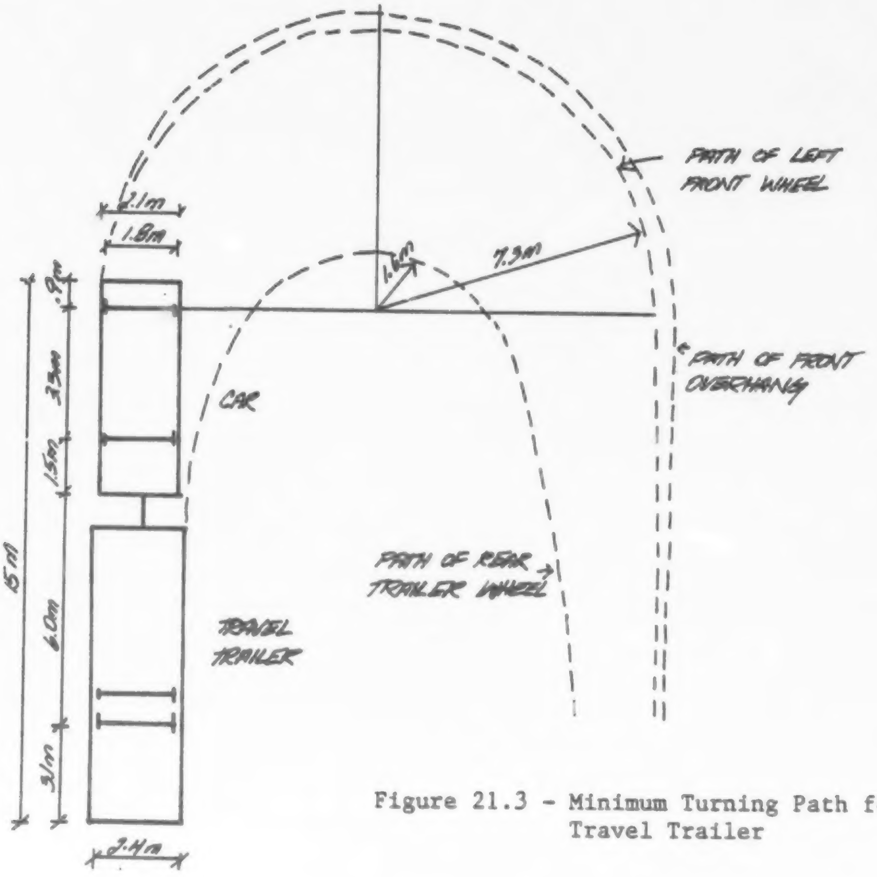

PATH OF LEFT FRONT WHEEL
2.1m
1.8m
.9m
3.3m
1.5m
15m
6.0m
3.1m
2.4m
1.6m
7.3m
PATH OF FRONT OVERHANG
CAR
PATH OF REAR TRAILER WHEEL
TRAVEL TRAILER

Figure 21.3 - Minimum Turning Path for Car and Travel Trailer

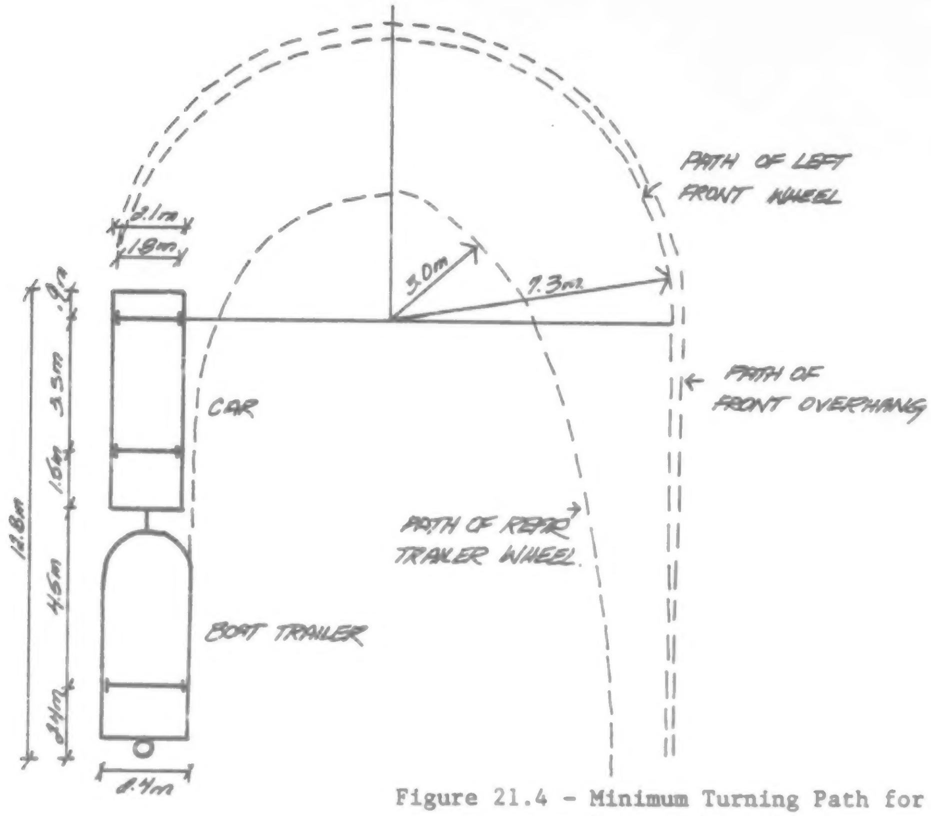

PATH OF LEFT FRONT WHEEL
2.1m
1.8m
.9m
3.5m
1.6m
12.8m
4.5m
2.4m
2.4m
3.0m
7.3m
PATH OF FRONT OVERHANG
CAR
PATH OF REAR TRAILER WHEEL
BOAT TRAILER

Figure 21.4 - Minimum Turning Path for Car and Boat Trailer

21.8 SELECTED REFERENCES

Douglass, Robert W. Forest Recreation. New York: Pergamon Press Inc., 1975.

Fogg, George E. Park Planning Guidelines. n.p.: National Society for Park Resources, 1975.

Gator, A & M. Seaby. Parks Canada Road Classification System and Geometric Design Standards. Draft. Department of Indian and Northern Affairs, Engineering and Architecture, Transportation Division, 1978.

Rutledge, Albert J. Anatomy of a Park. New York: McGraw-Hill Book Co., 1971.

U.S. Army Construction Engineering Research Laboratory. Design Guidelines For Recreational Roads. n.p.: Army Construction Engineering Research Laboratory, 1975.

22. PARKING

objective:

to provide an area for the storage of passenger cars as well as other recreational vehicles (ie. buses, trailers etc.).

22.0 PARKING:

- there are a variety of different parking layouts that can be recommended (30°, 45°, 60°, 90° or parallel parking) dependent on site requirements;
- the gross parking area per car is 33.0 m^2 (305 cars per hectare);
- the gross parking area per car/boat trailer is 69.0 m^2 (146 car/trailer units per hectare);
- recommend siting the parking lot on slopes of 0-5%;
- the maximum grade is 15%;
- the entry/exit to the parking lot should be 7.6 m wide, with a 3 m minimum turning radius;
- recommend a distance of 15.3 m between parking lot driveways and intersections although greater distances are preferred;
- average car stall is 3 m wide, 6 m long;
- average car/trailer stall is 3-3.6 m wide, 13.7 m long;
- a radius of 3 m is the minimum at intersections, but 3.7-4.5 m is recommended (especially if the lot is to be used by trailers, etc.);
- drop-off areas should be 3.8 m wide, and a minimum of 15 m long.

Table 22.1

Number of Parking Stalls Per Activity

Activity	Parking Space	Area of Activity
campground	1 parking space per	campsite
beach	1 parking space per	9.5 m^2
pool	1 parking space per	3.0 m^2
playing field	1 parking space per	288.0 m^2
golf course	1 parking space per	0.4 hectare
hotel	1 parking space per	2 room
motel	1 parking space per	1 unit
restaurant	1 parking space per	3-10 seats
church	1 parking space per	10 seats
shopping area	1 parking space per	12.0 m^2
tennis	5 parking spaces per	court & 4 for staff
boat launching	10-50 parking spaces per	ramp
trailer village	1-1 1/2 parking spaces per	trailer unit
picnic ground	2 parking spaces per	picnic site

22.1 GENERAL:

- when designing a parking lot consider the volume of use, type of use/vehicle, walking distance, security, association with facilities, aesthetic features and environmental factors;
- recommend moulding the parking lot into the surrounding terrain;
- where possible, the parking should be screened from other roads, and especially from activity areas;
- parking lots can either be located within the system or at terminal points of the sytem;
- there are two basic parking lot layouts:
  - i) the pull-through layout which is easiest to use, especially for cars and trailers, but tends to be expensive in construction costs, as well as in the area of land covered.

  - ii) the pull in/back out layout at either 30°, 45°, 60°, or 90° angle to the flow of traffic is more difficult to use if trailers or other large recreational vehicles are required to park there, but overall is less expensive to construct and covers a smaller land area.

- if and when overflow parking is required, it could be accommodated on stabilized turf rather than by constructing other parking lots;
- when a parking lot is located in association with other facilities such as a wayside park, the road can be extended, sufficiently widened, or a loop can be built to accommodate the required visitor parking;
- recommend careful planning so that parking facilities can be centralized and shared by various activities;
- recommend a careful and preventive approach at the design stage to avoid wind and water degradation of the surrounding environment;

- construct parking lots on permeable soils to allow as much natural seepage as possible;
- recommend a porous surface material such as gravel;
- allow for an overhead vegetative canopy to intercept rainfall and decrease run-off, as well as shade the vehicles during the day;
- recommend designing an adequate drainage system, as drainage from parking lot is going to be major;
- rectangular parking lots are the most efficient, (triangular or other irregularly shaped lots should be avoided);
- if parking area is very large, it is recommended that it be broken down into smaller lots;
- parking lots that are slightly curved or the provision of planting strips can aid in minimizing the view of a long line of cars;
- to minimize the overall effect of parking lots, can also use walls, fencing, berms, elevation changes, etc.;
- one entry/exit is ample in most cases;
- parking lot entry/exists should not be located near street intersections in order to prevent conflict with street traffic;
- parallel parking is not recommended, as it requires a greater overall area to park the same number of cars as some of the other lots;
- when designing parking lots to accommodate large trailers, buses, avoid layouts that require a reversing movement to park;
- signs and light fixtures in the parking lot should be protected by a raised curb;
- the layout of the parking lot should provide a safe place for pedestrians to move (so they do not have to cross the traffic flow);
- use wheel stops to control vehicle movement in a stall (e.g. logs, wood fences, curbs, bollards, etc.);

- a parking stall for the disabled should be 3.7 m wide and within 30 m of the facility/building;
- surfaces for parking lots accessible to the disabled should either be asphalt or concrete or compacted gravel;
- the layout of the parking lot should enable users to have direct access to trail/building, etc., without having to move behind parked cars;
- bollards should be a minimum of 0.6 m high and with a minimum spacing of 0.85 m;

Table 22.2

Turning Radius For Vehicles

	Minimum Inside	Desirable Outside
passenger car	4.7 m	7.9 m
single unit/bus	8.7 m	13.4 m
semi-trailer (15.0 m)	6.1 m	12.6 m
semi-trailer (16.7 m)	6.0 m	14.1 m

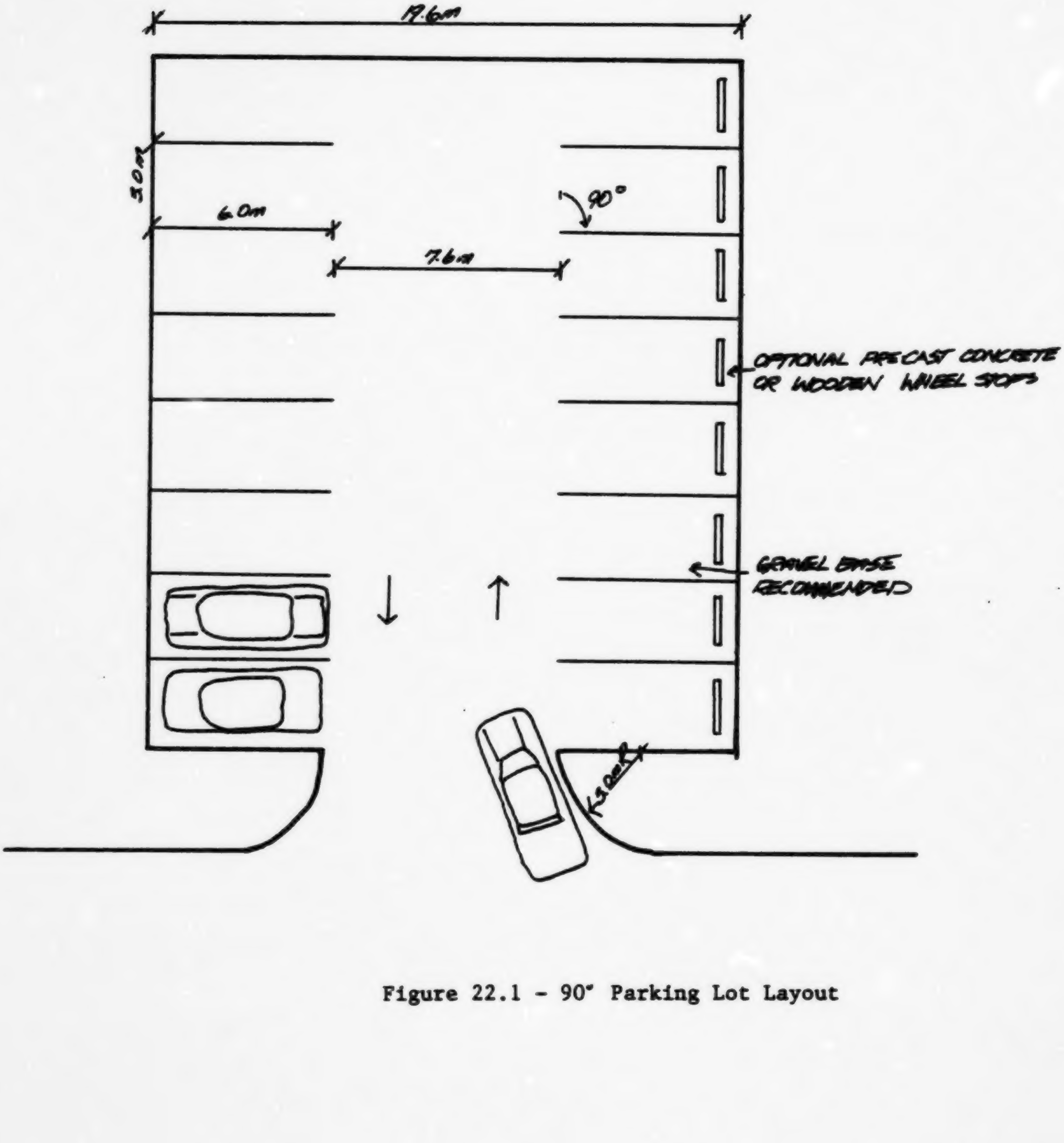

19.6m
3.0m
6.0m
7.6m
90°
OPTIONAL PRECAST CONCRETE OR WOODEN WHEEL STOPS
GRAVEL BASE RECOMMENDED
3.0mR

Figure 22.1 - 90° Parking Lot Layout

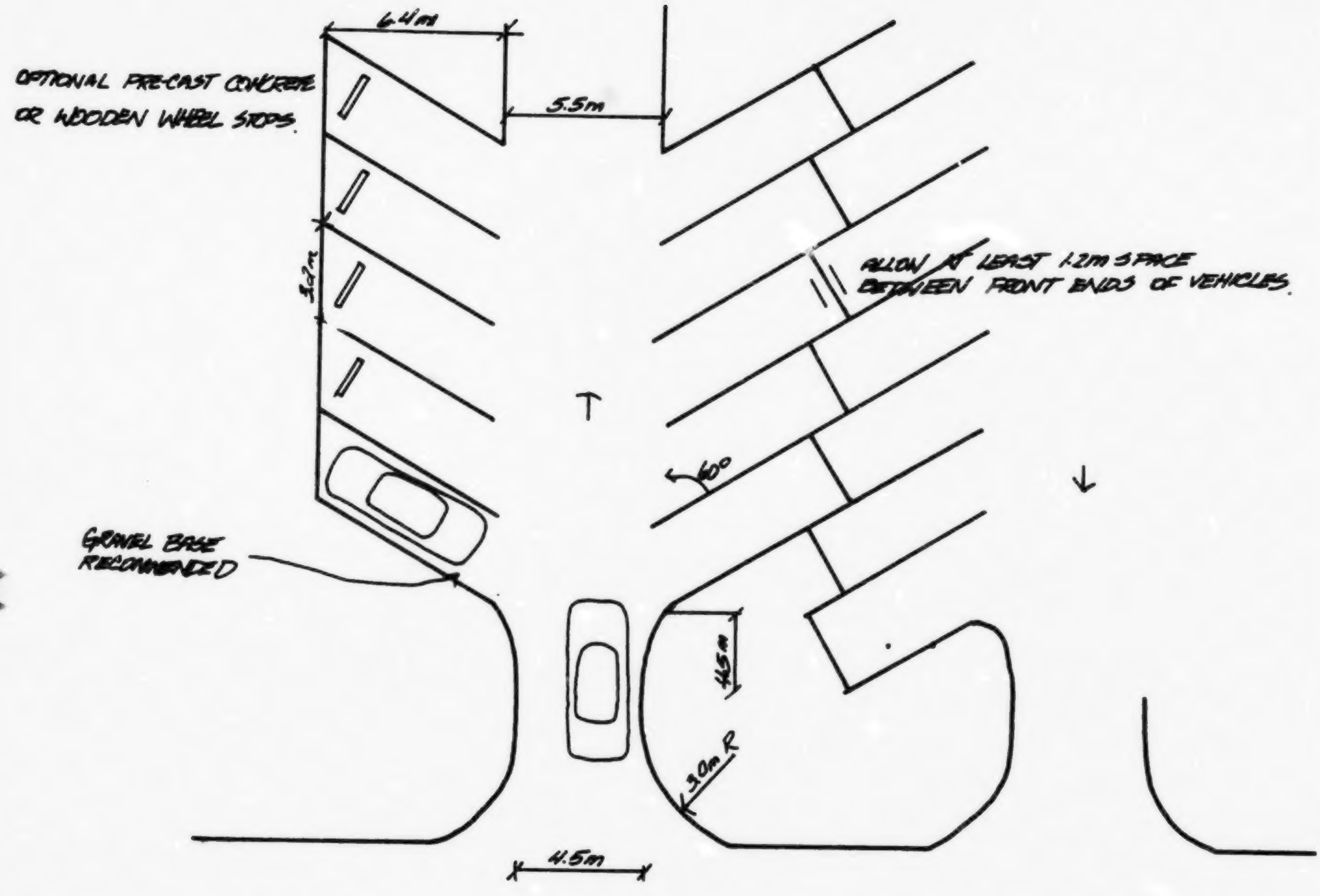
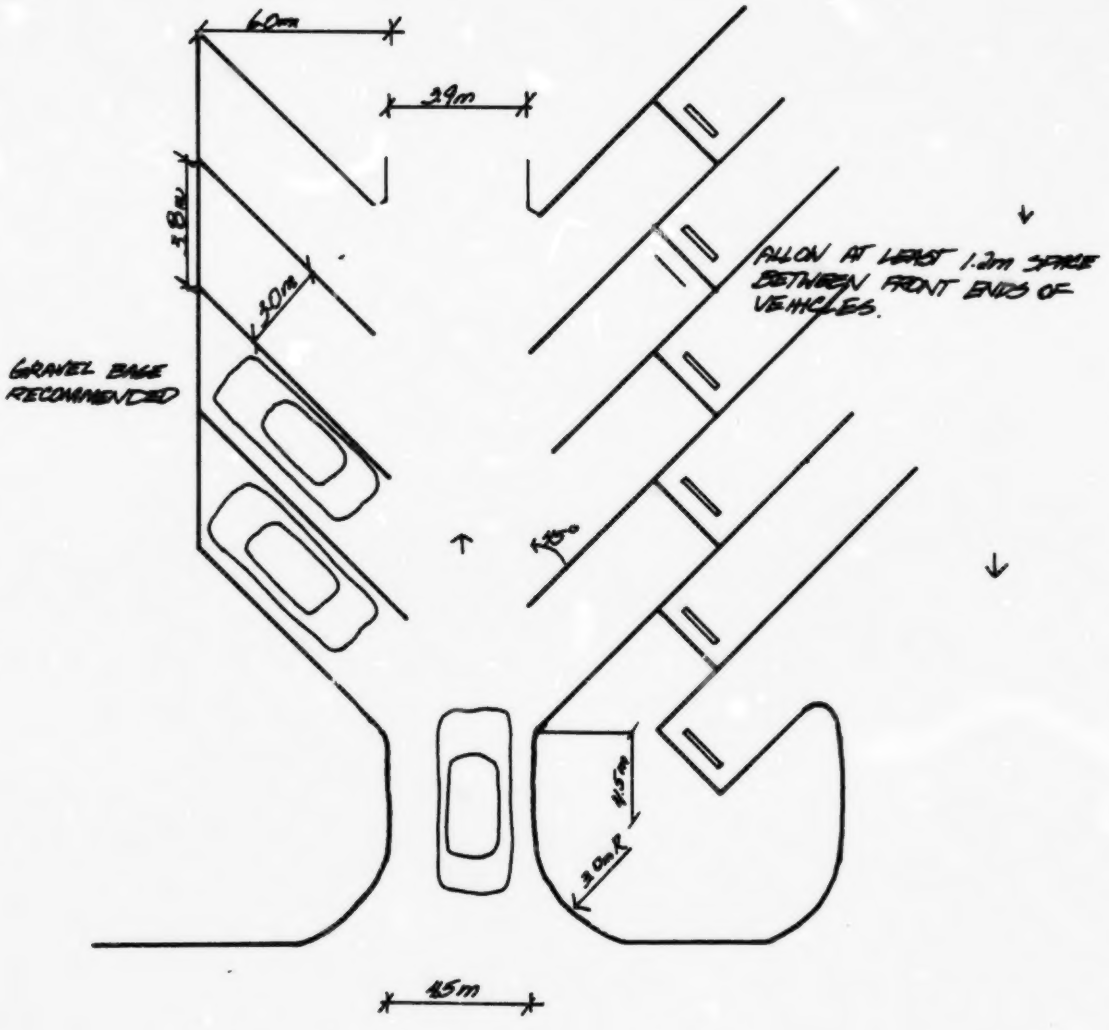

6.4m
OPTIONAL PRE-CAST CONCRETE OR WOODEN WHEEL STOPS.
5.5m
3.2m
ALLOW AT LEAST 1.2m SPACE BETWEEN FRONT ENDS OF VEHICLES.
T
60°
↓
GRAVEL BASE RECOMMENDED
4.5m
3.0m R
4.5m

Figure 22.2 - 60° Parking Lot Layout (One-Way)



60m
39m
38m
30m
GRAVEL BASE RECOMMENDED
ALLOW AT LEAST 1.2m SPACE BETWEEN FRONT ENDS OF VEHICLES.
45°
4.5m
3.0m R
45m

Figure 22.3 - 45° Parking Lot Layout (One-Way)

22.2 SELECTED REFERENCES

Canada Central Mortgage and Housing Corporation. Parking Area Advisory Document. Ottawa: Central Mortgage and Housing Corporation, 1980.

Carpenter, Jot. D., ed. The Handbook of Landscape Construction. New York: The Landscape Architecture Foundation, 1976.

Douglass, Robert. Forest Recreation. New York: Pergamon Press, Inc., 1975.

Fogg, George E. Park Planning Guidelines. n.p.: National Society for Park Resources, 1975.

23. GRAPHICS

objective:
to standardize commonly used graphic symbols.

23. STANDARD MAP SYMBOLS

23.1 Common Cartographic Symbols

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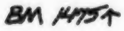
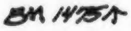
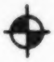
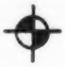
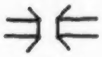
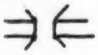
	bench mark with elevation	
	boring location	
	bridge	
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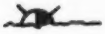
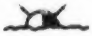
	buoy	
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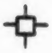
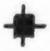
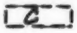
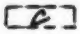
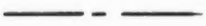
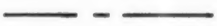
	catch basin	
	cemetery	
	centre line	
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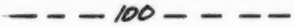
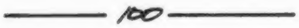
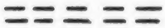
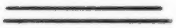
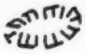
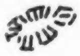
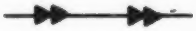
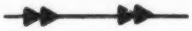
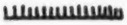
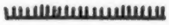
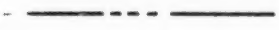
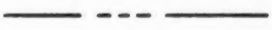
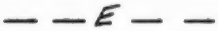
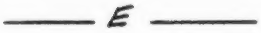
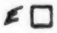
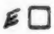
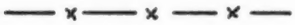
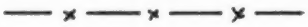
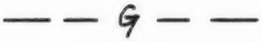
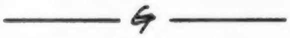
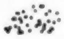
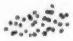
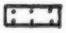
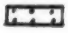
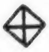
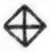
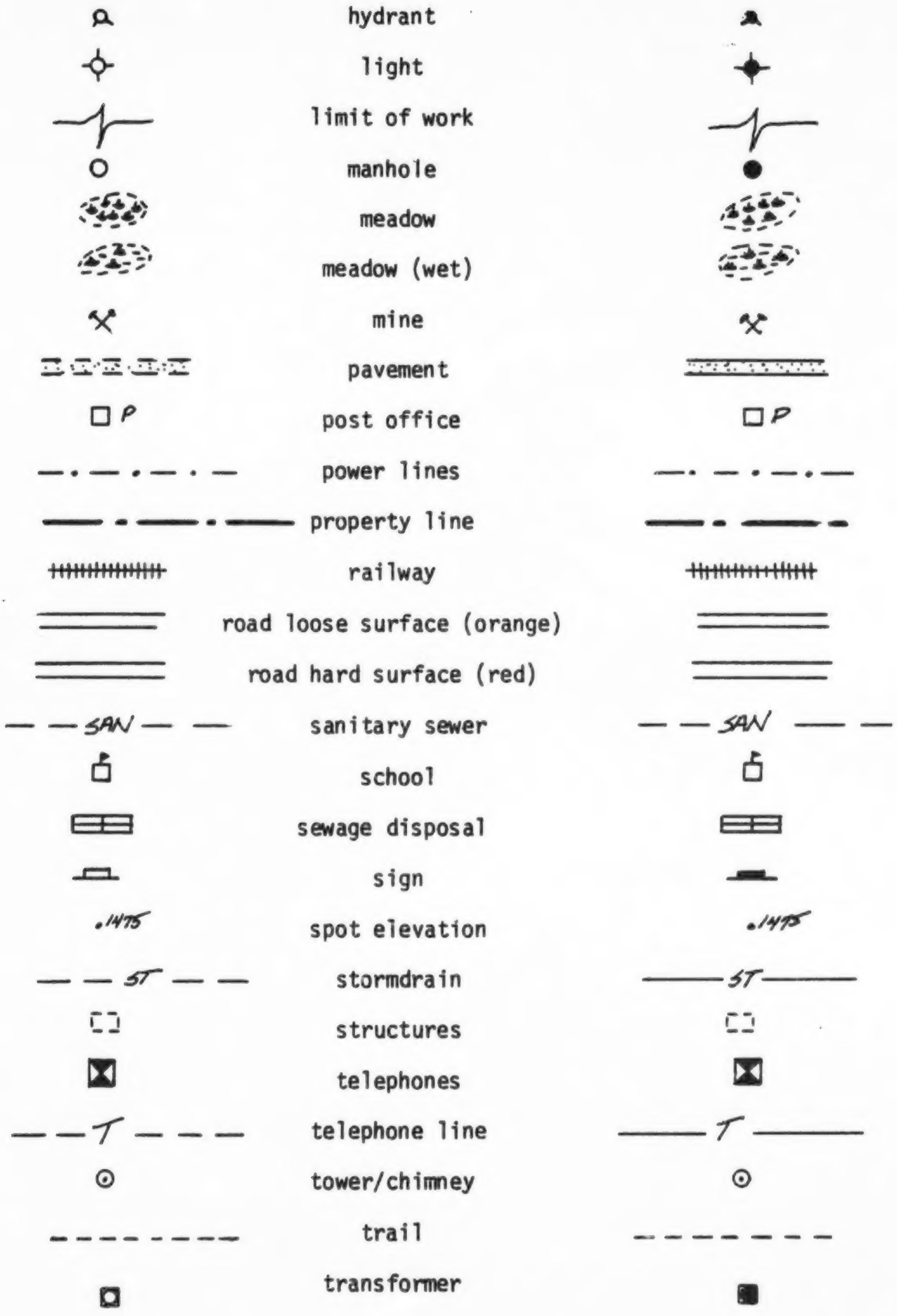
	contour	
	curb	
	depression	
	ditch	
	dyke	
	easement line, right of way	
	electrical line	
	elevator	
	fence	
	gas line	
	gravel pit	
	greenhouse	
	historic site	


hydrant
light
limit of work
manhole
meadow
meadow (wet)
mine
pavement
P
post office
P
power lines
property line
railway
road loose surface (orange)
road hard surface (red)
SAN
sanitary sewer
SAN
school
sewage disposal
sign
.1475
spot elevation
.1475
ST
stormdrain
ST
structures
telephones
T
telephone line
T
tower/chimney
trail
transformer

⊙	tree	⊕
— — W — —	water line	——W——
○ W.P.	water tap	○ W.P.

APPENDICES

A. VEGETATION

objective:

to clarify the planting stock available through the Park nursery (1982), as well as provide information on common species.

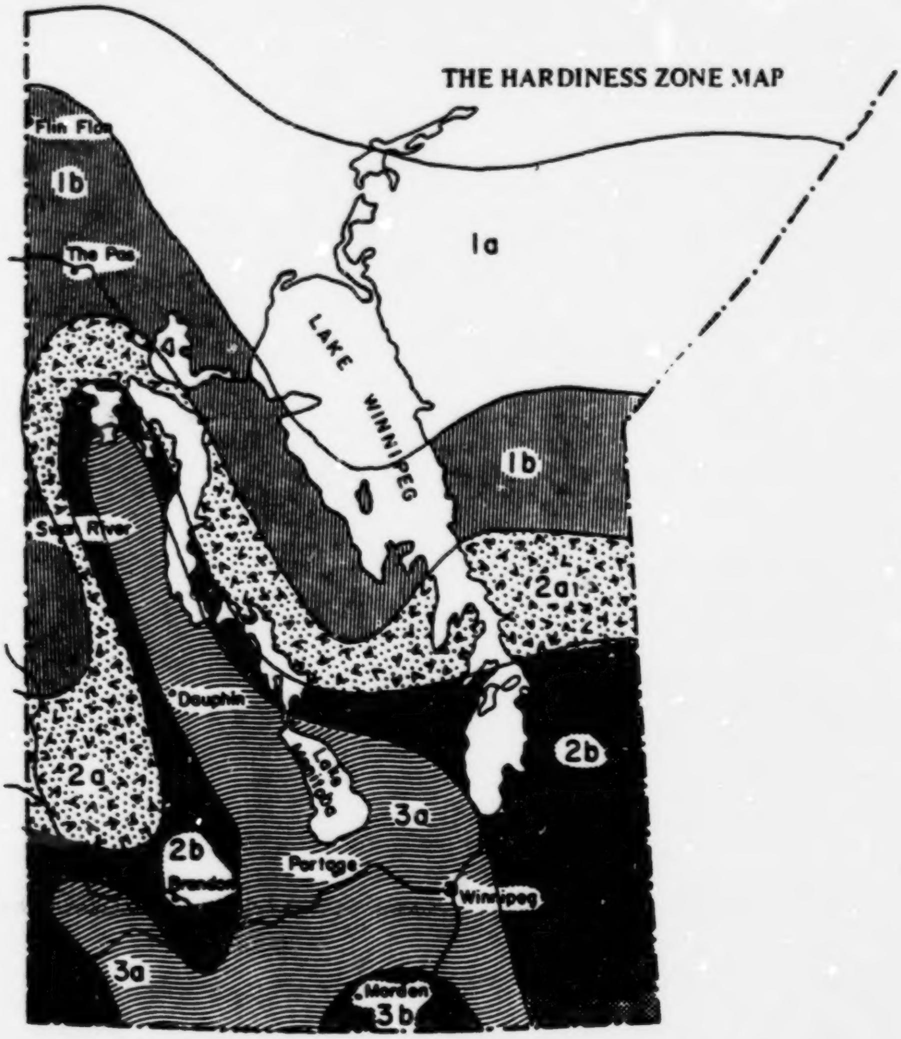
I. PLANTS AVAILABLE FROM PARK NURSERY STOCK

Ash, Green	*Fraxinus pennsylvanica subintegerrima*
Ash, Mountain	*Sorbus americana*
Buffaloberry	*Shepherdia argenta*
Chokecherry, Amur	*Prunus maacki*
Cranberry	*Viburnum trilobum*
Dogwood, Red-osier	*Cornus stolonifera "Red osier"*
Elder, Redman	*Sambucus racemosa*
Juniper, Blue Danube	*Juniperus sabina "Blue Danube"*
Juniper, Savin	*Juniperus sabina*
Juniper, Prince of Wales	*Juniperus horizontalis "Prince of Wales"*
Larch, Siberian	*Larix siberia*
Maple, Amur	*Acer ginnala*
Maple, Manitoba	*Acer negundo*
Poplar, Northwest	*Populus deltoides "Northwest"*
Poplar, Walker	*Populus deltoides*
Potentilla	*Potentilla fruiticosa "Coronation Triumph"*
Saskatoon	*Amelanchier alnifolia*
Spirea	*Spirea vanhouttei*
Spruce, Colorado	*Picea pungens*
Spruce, White	*Picea glauca*
Willow, Basford	*Salix alba "Chermesina"*
Willow, Laurel	*Salix pentandra*
Willow, Silky	*Salix alba "Sericea"*

I. (i) Future Species

Basswood	*Tilia americana*
Birch, Paper	*Betula papyrifera*
Currant, Alpine	*Ribes alpinum*
Hackberry	*Celtis occidentalis*
Hawthorne	*Crataegus mordensis*
Linden, Little Leaf	*Tilia cordata*
Nannyberry	*Viburnum lentago*
Rose	*Rosa spinosissima altakca*
Virginia Creeper	*Parthenocissus quinquefolia*
Willow, Arctic	*Salix surpurea "Nana"*

II. The Hardiness Zones


THE HARDINESS ZONE MAP
Flin Flon
1b
The Pas
1a
LAKE WINNIPEG
1b
Swan River
2a
Dauphin
2b
Lake Manitoba
2a
3a
2b
Brandon
Portage
Winnipeg
3a
Morden
3b

Source: "Recommended List of Ornamental Trees, Shrubs, Climbers, and Ground Covers for Manitoba." Prepared by a Committee of the Manitoba Horticultural Council, Department of Agriculture, Province of Manitoba. 1979.

"The Canadian Plant Hardiness Zone Map is used to provide an interpretation of the hardiness of the woody trees, shrubs, climbers, and ground covers in this list. All the plants have a hardiness zone rating indicating the areas in which they can be expected to grow satisfactorily under normal landscape conditions. Hardiness is governed by many factors including minimum winter temperatures, amount of rainfall and snow, wind conditions and frost-free period. For example, within the hardiness zone, local "islands" of greater severity due to exposure or less severity due to protection may result in variation of plant adaptibility and/or survival. Often a low growing plant that is continually protected by snow cover during the winter, will grow well in a colder zone than indicated. It must be stressed that the zone given is the coldest area for any particular plant and is only a guide and many plants may well thrive in a colder zone."[1]

III. Common Manitoba Trees

III.(i) Key

A. prefers moist soils
B. prefers dry soils
C. outstanding leaf color
D. outstanding stem color
E. interesting shape/form
F. showy flower and/or fruit
G. native species

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[1] Committee of the Manitoba Horticultural Council, Department of Agriculture, Province of Manitoba. Recommended List of Ornamental Trees, Shrubs, Climbers, and Ground Covers for Manitoba. (1979).

III. (ii) Commonly Used Plant Species

1. Ash, Black
2. Ash, Green
3. Aspen, Big-toothed
4. Aspen, Trembling
5. Basswood, American
6. Bearberry
7. Birch, Paper
8. Birch, Weeping
9. Bittersweet
10. Buckeye, Ohio
11. Buffaloberry
12. Caragana
13. Cedar
14. Chokecherry
15. Cottonwood
16. Cranberry
17. Creeper, Virginia
18. Dogwood, Alternate-leaf
19. Dogwood, Red-osier
20. Elder, American
21. Elm, American
22. Elm, Siberian
23. Fir, Balsam
24. Hackberry
25. Hawthorne, Downy
26. Hawthorne, Fleshy
27. Hazel
28. Hophornbeam
29. Juniper, Common
30. Juniper, Creeping
31. Maple, Manitoba
32. Maple, Mountain
33. Maple, Red
34. Maple, Silver
35. Mountain-ash
36. Mountain-ash
37. Nannyberry
38. Oak, Bur
39. Olive, Russian
40. Pincherry
41. Pine, Jack
42. Pine, Red
43. Pine, Scots
44. Plum, Canada
45. Poplar, Balsam
46. Rose, Prickly
47. Rose, Smooth
48. Saskatoon
49. Sumac, Smooth
50. Spruce, Black
51. Spruce, White
52. Tamarack
53. Wayfaring Tree
54. Willow, Bebb
55. Willow, Bog
56. Willow, Coyote
57. Willow, Peach-leaf
58. Willow, Pussy
59. Willow, European White

III. (iii) Species Description & Characteristics

1. Black Ash *Fraxinus nigra* (A,E,G)

description: deciduous tree with narrow, rounded crown of upright branches, slow growing

hardiness zone: 2

height: 9-15 m

diameter: 0.3 m

leaves: opposite, pinnately compound, 7-11 leaflets, broadly lance-shaped, turning brown in autumn

bark: grey, corky, fissured

flowers: purplish, small, male and female flowers on separate trees

fruit: key, with a broad oblong wing, in clusters

habitat: wet soils of swamps, peat bogs, streams, especially cold swamps where drainage is poor, in coniferous and hardwood forests

use: ornamental, shade tree, or lumber products

2. Green Ash *Fraxinus pennsylvanica* (A,C,E)

description: deciduous tree with a dense, rounded or irregular crown, fast growing, easily transplanted

hardiness zone: 1b

height: 18 m

diameter 0.5 m

leaves: opposite, pinnately compound, 5-9 but usually 7 leaflets, lance-shaped or ovate, turning yellow in the fall

bark: grey, furrowed into scaly ridges

twigs: green becoming grey

flowers: greenish, small, in small clusters, male and female on separate trees

fruit: yellowish key with a narrow wing, in clusters

habitat: moist alluvial soils along streams in floodplains, forests, or wet meadows

use: useful for hardwood products, good shade tree, or street tree, ideal for reclamation planting

3. Big-Toothed Aspen Populus grandidentata (A,B,C,G)

description: medium-sized deciduous tree with narrow, rounded crown, pioneer tree after fires, logging or in abandoned fields, short-lived, fast-growning, suckers readily

hardiness zone: 2b

height: 9-18 m

diameter: 0.3 - 0.5 m

leaves: broadly ovate, short-pointed tip, rounded at the base, coarse curved teeth, pale yellow in autumn, leafstalks flattended

bark: greenish, smooth, becoming dark brown and furrowed with scaly ridges

twigs: brown and slender

flowers: catkins, brownish in color, male and female on separate trees

fruit: narrow, short, conical capsules, light green in color

habitat: sandy, unland soils, floodplains, streams, often associated with trembling aspen

use: foliage, twigs, buds & twigs all consumed by wildlife

4. Trembling Aspen *Populus tremuloides* (A,B,C,D,E,G)

description: most widely distributed deciduous tree in North America, with a narrow rounded crown of thin foliage, is a pioneer species, fast growing, suckers readily

hardiness zone: 1a

height: 12-21 m

diameter: 0.3-0.5 m

leaves: nearly rounded, abruptly short-pointed, rounded at base, finely saw-toothed, golden yellow in autumn, leafstalks slender and flattened

bark: whitish, generally smooth, on large trunks becoming dark grey and furrowed

twigs: shiny brown in color

flowers: catkins, brownish, male and female on separate trees

fruit: narrowly conical, light green capsules in drooping catkins

habitat: many soil types, especially sandy and gravelly slopes, often in pure stands

use: ornamental, massing, twigs browsed by deer, elk, moose, sheep, goats; bark and foliage eaten by beaver, rabbits, and other mammals; buds eaten by grouse and quail

5. American Basswood *Tilia americana* (A,E,F,G)

description: large deciduous tree with long trunk and a dense crown, of small, often drooping branches, large leaves, moderate growth rate

hardiness zone: 2b

height: 18-30 m

diameter: 0.6-0.9 m

leaves: in two rows, broadly ovate or round, saw-toothed, palmately veined, turning pale yellow or brown in autumn

bark: dark grey, smooth, becoming fissured into narrow scaly ridges

twigs: reddish or green

flowers: small, yellowish-white, fragrant

fruit: nut-like, elliptical or rounded, grey in color

habitat: moist soils of valleys and uplands in hardwood forests

use: native species (hardy), climax species, shade and/or street tree use, ornamental; when it is flowering its full of bees (hence the nickname the bee tree), useful for lumber products, susceptible to aphids, borers, but fruit may prove to be a litter problem

6. Bearberry *Arctostaphylos uva-ursi* (A,C,E,F,G)

description: native species, evergreen, prostrate shrub

hardiness zone: 1

height: 13 cm

leaves: pinkish, lantern-shaped, in racemes

fruit: bright red drupe

habitat: open locations, near water, or on rocky uplands

use: forms mat-like ground cover for banks, slopes adaptable to poor, rocky, sandy or low in calcium soils, difficult to propogate

7. Paper Birch *Betula papyrifera* (A,C,D,E,G)

description: one of the most beautiful native deciduous trees, with a narrow open crown of slightly drooping to nearly horizontal branches, sometimes a shurb, fast-growing, nurse tree

hardiness zone: 1

height: 15-21 m

diameter: 0.3-0.6 m

leaves: ovate, long, pointed, coarsely and doubly saw-toothed, light yellow in autumn

bark: chalky to creamy white, smooth, separating into papery strips to reveal orange inner bark

twigs: reddish-brown in color

flowers: male small, yellowish drooping catkins near the tip of the twigs, female greenish, short upright catkins

cones: brownish, cylindrical, hanging on slender stalks with many two-winged nutlets

habitat: moist, upland soils and cut-over lands, often in nearly pure stands

use: lumber, shade tree, frequently used in clumps, ornamental nurse tree

8. Weeping Birch Betula pendula (A,C,D,E)

description: deciduous, naturalized tree with an open pyramidal or spreading crown of long drooping branches; short-lived, graceful appearance, rapid growth rate

hardiness zone: 2b

height: 15 m

diameter: 0.3 m

leaves: ovate or nearly triangular, doubly saw-toothed, dull green above, yellow fall color

bark: white, smooth, flaky, peeling in papery strips

twigs: slender and drooping

flowers: tiny, male yellowish, female greenish colored catkins

cones: cylindrical, hanging on slender stalks, composed of many small two winged nutlets

habitat: moist soils, in lawn or park areas, sometimes escapes into thickets and open forest areas, will not tolerate long wet or dry conditions

use: ornamental or shade tree

9. Bittersweet Celastrus scandens (A,E,F,G)

description: deciduous, native climber, woody, coarse texture, fast growing

hardiness zone: 2

leaves: large, ovate to ovate-lanceolate, alternate, yellow fall color

flowers: imperfect, dioecious, in terminal panicles or racemes, small, greenish in color

fruit: yellow, in capsule with crimson seeds, persistant

use: as a climber

10. Ohio Buckeye *Aesculus glabra* (A,C,E)

description: naturalized deciduous tree with upright flowers at the ends of the twigs, irregular rounded crown, sometimes shrubby; twigs and leaves have an unpleasant odour when crushed; slow growing

hardiness zone: 3

height: 9-21 m

diameter: 0.3-0.6 m

leaves: opposite, palmately compound, 5-7 leaflets, elliptical shape, unevenly saw-toothed, yellow-green above, paler beneath, orange-yellow color in fall

bark: ashy grey color, rough and furrowed with age, unpleasant odor

twigs: reddish brown

flowers: bell-shaped, yellow, poisonous

habitat: rich moist soils of valleys, drier sites, sometimes a thicket-forming shrub on stream banks, mixed hardwood forests

use: seed and young foliage are poisonous; ornamental, showy fall color, lumber products

11. Buffaloberry *Shepherdia argenta* (A,C,E,F,G)

description: native deciduous, small bushy tree

hardiness zone: 1b

height: 4-6 m

leaves: linear, silvery on both sides, opposite

bark: silvery when young, becoming flaky and brown with age

twigs: thorny branchlets

flowers: yellow, clusters along stems, male and female on separate trees

fruit: drupe, red-yellow in color

habitat: wet areas, such as sloughs and coulees

use: a good drought-resistant ornamental

12. Common Caragana *Caragana aborescens* (B,D)

description: naturalized, deciduous, a member of the pea family, not attractive, does not branch freely unless pruned, becomes leggy with age

hardiness zone: 1b

height: 4 m

leaves: compound, 8-12 leaflets, fine texture

bark: gold in color

flowers: yellow, pea-like, single

fruit: long, narrow, brown pods

habitat: dry situations

use: untidy ornamental, fast growing, strongly competitive, edible flowers and fruit, excellent for hedges or massings (keep 2.5 m from fruit trees)

13. Eastern White Cedar *Thuja occidentalis* (A,E,G)

description: native, evergreen, resinous and aromatic tree with angular often-branched trunk, narrow conical crown, slow growing

hardiness zone: 2

height: 12-21 m

diameter: 0.3-0.9 m

leaves: evergreen, opposite in four rows, scale-like, dull yellow-green above, paler blue-green beneath

bark: light red-brown, shreddy, fissured into narrow ridges

twigs: flattened, branching in horizontal pattern

cones: elliptical, small light brown

habitat: swamps, neutral-alkaline soils, limestone uplands, often in pure stands

use: lumber, ornamental, massings, but not drought tolerant

14. Chokecherry Prunus virginiana (A,C,F,G)

description: deciduous, native, small tree or shrub, forming dense thickets

hardiness zone: 1b

height: 6 m

diameter: 15 cm

leaves: elliptical, finely but sharply saw-toothed, shiny dark green above, light green in color, sometimes hairy below, yellow fall color

bark: brown or grey, smooth

twigs: brown, with a disagreeable odor and taste

flowers: small, white

fruit: chokecherry, small, shiny dark red or blackish skin, juicy but bitter pulp, large stone

habitat: moist soils especially along streams, forest borders, clearings and roadsides

use: edible fruit, stones are poisonous, wilted foliage poisonous to livestock; ornamental, useful in massings

15. Cottonwood Populus deltoides occidentalis (A,C,E,G)

description: large deciduous tree with a massive trunk, often forked into stout branches, broad open crown of spreading and slightly drooping branches, fast growing, native, short life span

hardiness zone: 2b

height: 30 m

diameter: 0.9-1.2 m, often larger

leaves: triangular, long-pointed, usually straight at base, curved coarse teeth, yellow fall color

bark: yellowish-green, smooth, becoming light grey with age

twigs: brownish, stout

flowers: catkins brownish

fruit: elliptical capsules

habitat: bordering streams and in wet soils of valleys, often in pure stands or with willows, pioneers on new sand-bars and bare floodplains

use: one of the largest hardwoods in Manitoba, good shade tree, shelter belt, humming birds use the seed fluff in their nests

16. American Highbush Cranberry Viburnum trilobum (A,C,E,F,G)

description: native deciduous shrub, tolerates full sun or shade, attractive, spreading-globular form

hardiness zone: 1b

height: 2.7 m

leaves: finely-toothed, terminal lobe; reddish fall color

flowers: white, flattened, terminal umbel-like cymes

fruit: scarlet, edible, clusters

habitat: old river beds, shady, moist habitat

use: ornamental, edible fruit

17. Virginia Creeper Parthenocissus quinquefolia (A,C,E)

description: deciduous shrub, climbs on tendrils, rarely upright, fast growth rate.

hardiness zone: 2

leaves: alternate, palmately compound, five leaflets, coarsely serrated, scarlet fall color

bark: grey and shreddy, young growth is red in color

flowers: perfect, greenish, small in cymes, opposite the leaves

fruit: round, bluish-black in color, clusters

use: climber, but requires pruning, good ground cover, but susceptible to powdery mildew

18. Alternate Leaf Dogwood Cornus alternifolia (A,C,E,F,G)

description: native, deciduous, shrub or small tree with a short trunk, flat-topped spreading crown of young horizontal branches

hardiness zone: 3

height: 4.6 m

diameter: 15 cm

leaves: alternate, elliptical appearing not toothed, but does have tiny teeth on edges, yellow-red fall color

bark: grey-brown, smooth or fissured

flowers: white, in small clusters

fruit: berry-like, blue-black on red stems, thin bitter pulp

habitat: moist soils, in understory of hardwood and coniferous forest

use: ornamental, massings, berries are edible

19. Red-Osier Dogwood *Cornus stolonifera* (A,D,E,G)

description: native, deciduous, large spreading, thicket-forming shrub with several stems, clusters of small white flowers and fruit, spreads by underground stolons

hardiness zone: 1b

height: 1.3 - 4.6 m

diameter: 7.5 cm

leaves: opposite, elliptical or ovate

bark: grey-brown color, smooth or slightly furrowed

twigs: purplish-red when young

flowers: white in flat upright clusters

fruit: whitish, small

habitat: moist soils, especially along streams forming thickets and in understory of forests

use: erosion control for stream banks, ornamental and good in massing

20. American Elder *Sambucus canadensis* (A,E,F)

description: naturalized, deciduous, large shrub or small tree with irregular crown of few stout spreading branches, clusters of white flowers and many small purple-black berries, suckers readily

hardiness zone: 2b

height: 5 m

diameter: 15 cm

leaves: opposite, pinnately compound, 3-7 leaflets, paired except at end, elliptical sharply saw-toothed, shiny green above, dull light green below, sometimes partly bipinnate with up to 13 leaflets

bark: light grey or brown, with raised dots, smooth or becoming rough and fissured.

twigs: light green

flowers: fragrant upright flat-topped much-branched clusters

fruit: small black or purplish berry, juicy, slightly sweet

habitat: wet soils especially in open areas near water, at forest's edge

use: edible fruit for man and animal; massing

21. American Elm *Ulmus americana* (A, C, E, G,)

description: native, deciduous, large tree, trunk often forks into many spreading branches, drooping at ends, forming a broad, rounded, flat-topped or vase-like crown

hardiness zone: 2a

height: 30 m

diameter: 1.2 m, sometimes larger

leaves: in two rows, elliptical, doubly saw-toothed with many straight parallel side veins, dark green color, yellow in fall

bark: light grey, deeply furrowed

twigs: brownish, slender

flowers: greenish, clustered along twigs

fruit: elliptical, flat one-seeded keys (samaras)

habitat: moist soils, especially in valleys, flood plains, also in mixed hardwood forests

use: shade or street tree, ornamental, good for lumber, but susceptible to Dutch Elm Disease

22. Siberian Elm *Ulmus pumita* (B, C, E)

description: naturalized deciduous tree, medium-sized, open rounded crown of slender, spreading branches, fast growth rate

hardiness zone: 2a

height: 18 m

diameter: 0.5 m, usually smaller

leaves: narrowly elliptical, blunt-based, saw-toothed, with many straight veins, dark green above, turning yellow in fall

bark: grey-brown color

fruit: clustered, flat one-seeded keys (samaras)

habitat: dry regions, tolerant of poor soils and city smoke, also scattered in moist soils of stream banks

use: less susceptible or possibly resistant to Dutch Elm Disease, good street and shade tree

23. Balsam Fir Abies balsamea (A, C, E)

description: naturalized, evergreen tree with narrow pointed spire-like crown of spreading branches, aromatic foliage, not resistant to dust and smoke, becomes open with age

hardiness zone: 1

height: 12-18 m

diameter: 0.3-0.5 m

needles: evergreen, spreading, almost at right angles, in two rows, flat, shiny dark green

bark: brown, smooth with resin blisters

cones: cylindrical, dark purple, upright, on topmost twigs

habitat: often in pure stands, wet meadow and coniferous forests

use: lumber products, deer and moose browse foliage, specimen tree, windbreak

24. Hackberry Celtis occidentalis (A, C, D, E, G)

description: deciduous tree with rounded crown of spreading or slightly drooping branches, climax species

hardiness zone: 2b

height: 15-27 m

diameter: 0.5-0.9 m

leaves: two rows, ovate, long-pointed usually sharp-toothed, yellow in fall

bark: grey or light brown, smooth with corky warts or ridges

twigs: light brown

flowers: narrow, greenish color

fruit: small, orange - dark purple drupes, dry, sweet

habitat: mainly in river valleys, also on upland slopes and bluffs in mixed hardwood forests

use: lumber products, berries eaten by quail, pheasants, woodpeckers, cedar wax wings, subject to witches broom

25. Downy Hawthorn *Crataegus mollis* (A, E, F)

description: naturalized, deciduous handsome tree with tall trunk and compact rounded crown of spreading branches, large broad hairy leaves, many large flowers, difficult to transplant

hardiness zone: 2

height: 12 m

diameter: 0.3 m

leaves: broadly ovate, short-pointed at tip, rounded or slightly notched at base, doubly saw-toothed, densely covered with white hairs when young

bark: grey-brown, fissured and thick

twigs: covered with white hairs when young with stout spines, though sometimes thornless

flowers: white in clusters

fruit: scarlet, juicy pulp, drooping clusters

habitat: moist soil of valleys, hillsides in open woods

use: ornamental, hedges, windbreaks

26. Fleshy Hawthorn *Crataegus succulenta* (A, D, F)

description: naturalized, deciduous shrub or small tree with a short trunk and broad irregular dense crown of stout branches

hardiness zone: 2

height: 6 m

diameter: 15 cm

leaves: elliptical, gradually narrowed from middle to base, doubly saw-toothed, shallow-lobed beyond middle, shiny dark green

bark: dark red-brown, scaly

twigs: stout, with slightly curved spines

flowers: white

fruit: bright red, thick juicy sweet pulp

habitat: moist soils of valleys and open upland areas

use: ornamental, massings, hedges, edible fruit

27. Hazel *Corylus cornuta* (A, C, F, G)

description: native deciduous, medium-to-coarse textured shrub

hardiness zone: 2

height: 2.0 m

leaves: bronze-red in autumn

fruit: bristly, hairy husk, becoming beak-shaped at the top

habitat: common in understory of aspen parkland

use: not a good ornamental, nesting for songbirds, squirrels, berries edible (usually deer and grouse), massing

28. Hop Hornbeam *Ostrya virginiana* (A, C, E, G)

description: deciduous tree with a trunk that looks like sinewy muscles, rounded crown of slender spreading branches, slow growth rate

hardiness zone: 3

height: 6-15 m

diameter: 0.3 m

leaves: ovate or elliptical, sharply double saw-toothed, parallel side veins, dull yellow-green color, yellow fall color

bark: light brown, finely fissured into long narrow scaly ridges

flowers: tiny male greenish clusters, female reddish-green clusters

fruit: tiny cone like hanging clusters, composed of many flattened small, egg-shaped brown nutlets

habitat: moist soil in understory of upland, hardwood forests

use: nutlets eaten by bobwhites, pheasants, grouse, deer and rabbits, lumber products, ornamental

29. Common Juniper *Juniperus communes* (B, C, E, G)

description: native species, evergreen, shrub form, fast growth rate

hardiness zone: 2b

height: 0.7 m

branches: slender, smooth, 3-angled becoming rounded

bark: reddish-brown, peeling off in papery layers

leaves: awl-like in three's joined at the base, linear to lanceolate, shiny green

fruit: small berry-like cones with small bracts at the base

habitat: rocky uplands, dry meadow, disturbed sites

use: ornamental, foundation massing, however, cannot tolerate early spring sun on south exposure

30. Creeping Juniper *Juniperus horizontalis* (B, C, E, G)

description: native species, evergreen, procumbent spreading shrub, with long trailing branches, fast growing

hardiness zone: 1

height: 15 cm

needles: juvenile awl-like, adult are scale-like, bluish-green to steel blue, turning purple-bronze in autumn

fruit: berry-like cones, light blue in color

habitat: rocky uplands, dry meadow, disturbed sites

use: massing, ground cover, foundation planting

31. Manitoba Maple *Acer negundo* (A, B, C, E, G)

description: native species, deciduous, small to medium-sized tree with a short trunk and a broad rounded crown, climax species, fast growing, suckers readily, subject to disease

hardiness zone: 2a

height: 9-18 m

diameter: 0.8 m

leaves: opposite, pinnately compound, 3-7 leaflets, coarsely saw-toothed, yellow-red in fall

bark: light grey-brown, many narrow ridges and fissures

flowers: yellow-green in color, in drooping clusters

fruit: paired, slightly forking keys

habitat: wet or moist soils along stream banks and in valleys with various hardwoods, also naturalized in waste places and roadsides

use: shade, street tree, shelterbelt, but suckers readily

32. Moutain Maple *Acer spicatum* (A, C, G)

description: native species, deciduous shrub or small tree with a short trunk and slender upright branches, forms part of understory layer, moderate growth rate

hardiness zone: 2a

height: 7.6 m

diameter: 15 cm

leaves: opposite, broad lobes, coarsely saw-toothed, leaf stalks often turn red, bright red-orange in autumn

bark: brown, slightly furrowed

flowers: greenish-yellow in upright clusters

fruit: paired, forking, long-winged keys, red or yellow when immature, brown when mature

habitat: moist rocky uplands, in understory of hardwood forests

use: adapted to shady areas, provides food (buds and bark) for rabbits, beaver, deer, moose and ruffed grouse, massing, windbreaks

33. Red Maple *Ace rubrum* (A, B, C, E, F, G)

description: native species, deciduous tree, rare in Manitoba, narrow or rounded, compact crown, red flowers, fruit, leaf stalk and fall foliage

hardiness zone: 2b

height: 18-27 m

diameter: 0.8 m

leaves: opposite, broadly ovate with three shallow short-pointed lobes, red-yellow fall color

bark: grey, smooth, becoming fissured with age

flowers: reddish in color, small, stalkless clusters

fruit: paired, forking keys, red turning reddish-brown

habitat: wet or moist soils of stream banks, valleys, swamps, uplands and sometimes on dry ridges in mixed hardwood forests

use: shade tree, ornamental

34. Silver Maple *Acer saccharinum* (A, C)

description: large deciduous tree with short, stout trunk, open irregular crown, graceful, naturalized, fast growth rate, susceptible to disease

hardiness zone: 3

height: 15-24 m

diameter: 0.9 m

leaves: long, opposite, wide and broadly ovate, deeply lobed, doubly saw-toothed, dull green above, silvery white below, pale yellow fall color

bark: grey, becoming furrowed into long scaly, shaggy ridges

flowers: reddish buds, turning greenish-yellow

fruit: long broad wing, paired, light brown key

habitat: wet soils of stream banks, flood-plains and swamps

use: shade tree, ornamental, wildlife cover

35. Mountain Ash, American *Sorbus americana* (A,C,D,E,F,G)

description: native, deciduous, small tree with spreading crown, or a small shrub with many stems and with showy white flowers, bright red berries

hardiness zone: 1b

height: 9 m

diameter: 20 cm

leaves: pinnately compound, 11-17 stalkless, lance-shaped leaflets, long-pointed, saw-toothed, yellow-green above, paler beneath, yellow fall color

bark: light grey-bronze, smooth

twigs: reddish-brown in color

flowers: white, small

fruit: small, apple-like, bright red skin, bitter pulp, clusters

habitat: moist soils of valleys and slopes in coniferous forests

use: ornamental (subject to iron chlorosis, fire blight, etc.) berries edible by man and animal (i.e. grouse, grosbeaks, cedar wax wings); moose browse the foliage, winter twigs and fragrant inner bark

36. Mountain Ash, Showy *Sorbus decora* (A,C,E,F)

description: naturalized, deciduous shrub or small tree with spreading rounded crown, showy white flowers, large bright red berries

hardiness zone: 1b

height: 9 m

diameter: 20 cm

leaves: pinnately compound, 15 stalkless leaflets, small elliptical to long, saw-toothed, blue-green above, paler underneath, orange in autumn

bark: dark grey, smooth to scaly

twigs: stout, hairy when young

flowers: white, in terminal upright clusters

fruit: small (but larger than spp. #5), apple-like bright red skin, bitter pulp

habitat: moist soils of valleys and slopes

use: ornamental, fruit is edible

37. Nannyberry *Viburnum lentago* (A, C, E, F, G)

description: native species, deciduous shrub or small tree with a short trunk, compact rounded crown of drooping branches, suckers if roots are disturbed

hardiness zone: 2a

height: 6 m

diameter: 15 cm

leaves: opposite, elliptical, finely saw-toothed, shiny green, purplish-orange-red in fall

bark: reddish brown-grey, irregularly furrowed into scaly plates, unpleasant skunk-like odor

flowers: slightly fragrant, upright, stalkless clusters

fruit: elliptical or nearly round, slightly flat, blue-black, sweet, juicy pulp

habitat: moist soils of valleys and rocky uplands at forest edges, riverbanks, lakeshores

use: fruit is edible, massing and understory layer

38. Bur Oak *Quercus macrocarpa* (B, E, F, G)

description: deciduous tree with large acorns, stout trunk, and broad rounded, open crown of stout often crooked spreading branches, sometimes a shrub, slow growth rate, deep tap root, difficult to transplant

hardiness zone: 2

height: 15-24 m

diameter: 0.6-1.2 m

leaves: obovate, broadest beyond middle, lower half deeply divided into 2-3 lobes on each side, upper half usually with 5-7 shallow rounded lobes, yellow-brown in fall

bark: light grey, thick, rough, deeply furrowed into scaly ridges

acorns: large, broadly elliptical, one half to three quarters enclosed by large deep cup, fringe-like border

habitat: dry uplands on limestone and gravelly ridges, sandy plains and loamy slopes, moist plains of streams, often in nearly pure stands

use: shade and street tree, ornamental, shelterbelt, acorns and bark edible by grouse, squirrels, rabbits, deer and porcupine

39. Russian Olive Elaegnus angustifolia (A, C)

description: naturalized species, deciduous shrub or tree, often with a crooked or leaning trunk, dense crown of low branches, silvery foliage and sometimes spiny twigs

hardiness zone: 3b

height: 6 m

diameter: 10 cm

leaves: wide, lance-shaped or oblong without teeth, dull grey-green color, silvery and brown dotted beneath

bark: grey-brown, fissured, shedding in long strips

flowers: bell-shaped, silvery, fragrant

fruit: berry-like, elliptical, yellow-brown with silvery scales, sweet, edible pulp

habitat: moist soils, from salty to alkaline in ph value

use: ornamental, not very hardy, edible fruit for cedar wax wings, robins, grosbeaks, pheasants and quail, massing

40. Pincherry Prunus pennsylvania (A, C, E, F, G)

description: small, native deciduous tree or shrub with horizontal branches, narrow rounded open crown, shiny red twigs, bitter aromatic bark, difficult to transplant

hardiness zone: 1b

height: 9 m

diameter: 0.3 m

leaves: broadly lance-shaped, finely and sharply saw-toothed, shiny dark green above, paler beneath, scarlet in fall

bark: reddish-grey, smooth

flowers: white, small

fruit: cherry, small, red skin, thin sour pulp, large stone

habitat: moist soil often in pure stands on burned areas and clearings with aspens, birch, white pine, intolerant of shade

use: pioneer species/nurse tree, bark edible by deer and bear, fruit edible by man and many animals, ornamental

41. Jack Pine *Pinus banksiana* (A, B, C, G)

description: native species, evergreen tree with open crown and spreading branches with very short needles

hardiness zone: 1

height: 9-21 m

diameter: 0.3 m

needles: evergreen, two in a bundle, stout slightly flattened and twisted, widely forking

bark: grey brown to dark brown

cones: narrow, long pointed, curved upward, shiny light yellow, remaining closed on tree

habitat: sandy soils, dunes, rock outcrops, often in pure stands

use: pioneer species after fires/logging, good for massing

42. Red Pine *Pinus resinosa* (B, C, E, G)

description: native species, evergreen tree with broad, irregular or rounded crown of spreading branches, slow growing

hardiness zone: 2b

height: 21-24 m

diameter: 0.3-0.9 m, often larger

needles: evergreen, two in a bundle

bark: reddish-brown or grey

cones: egg-shaped, shiny light-brown, shed at maturity

habitat: well-drained soils, sand plains, mixed forests

use: ornamental, shade, lumber products, massing

43. Scots Pine *Pinus sylvestris* (A, B, E)

description: naturalized species, evergreen tree with crown of spreading branches that become rounded and irregular, rich blue-green color, excellent form

hardiness zone: 2

height: 21 m

diameter: 0.6 m, or larger

needles: evergreen, two in a bundle, stiff slightly flattened twisted

bark: reddish-brown, becoming grey

cones: egg-shaped, pale yellow-brown color, short stalked

habitat: various soils from loams to sand, tolerates city smoke

use: shelterbelts, specimen

44. Canada Plum *Prunus nigra* (A, E, F, G)

description: native species, small, deciduous tree with a short trunk, several upright branches, narrow crown

hardiness zone: 2b

height: 6 m

diameter: 20 cm

leaves: elliptical, long, narrow pointed tip, doubly saw-toothed

bark: light grey-brown

flowers: white fading to pink, fragrant, small size

fruit: plum, small elliptical thick red or yellowish-red skin, yellow edible pulp, large stone

habitat: moist soils of valleys and hillsides

use: edible fruit (man and animal), ornamental

45 Balsam Poplar *Populus balsamifera* (A, C, E, G)

description: large deciduous tree with narrow open crown of upright branches and fragrant resinous buds, strong balsam odor, native species, fast growth rate, suckers badly

hardiness zone: 1b

height: 18-24 m

diameter: .0.3-0.9 m

leaves: ovate, pointed at tip, rounded or slightly notched at base, leafstalks are round, yellow fall color

bark: light brown, smooth, becoming grey furrowed

flowers: catkins, brownish

fruit: egg-shaped capsules

habitat: moist soils of valleys, stream banks, sandbars, flood plains lower slopes and in pure stands

use: lumber products, windbreaks

46. Prickly Rose *Rosa acicularis* (A, B, C, F, G)

description: native species, deciduous shrub, low growing, in some situations it is the pioneer species, but can be a climax species

hardiness zone: 1b

height: 1.3 m

leaves: 5-7 leaflets, compound, alternate, odd-pinnate, stipulate turning reddish in fall

bark: greyish, small spines

flowers: deep rose-colored, single

fruit: pear-shaped with distinct neck, deep crimson

habitat: prairie, aspen upland, disturbed sites

use: nesting cover, dried fruit is edible, winter color, not a specimen to view alone, massings better

47. Smooth Rose Rosa blanda (A, B, C, F, G)

description: native species, deciduous shrub

hardiness zone: 1b

height: 1.0 m

leaves: compound, alternate, 5-7 leaflets, red color in fall

bark: reddish color

flowers: single, light pink, slightly fragrant

fruit: red

habitat: prairie, aspen parkland, disturbed sites

use: massing, edible fruit

48. Saskatoon Amelanchier alnifolia (A, C, F, G)

description: native species, deciduous shrub or small tree, usually with several trunks, pioneer species, shallow root system

hardiness zone: 2

height: 9 m

diameter: 20 cm

leaves: broadly elliptical to nearly round, coarsely toothed above middle, orange-red fall color

bark: grey or brown and smooth

flowers: white, terminal clusters

fruit: small, apple-like, purple-black, edible, sweet, juicy

habitat: moist soils in forests and openings

use: fruit edible by squirrels, bears, livestock, foliage edible by deer, shade tolerant, massings, borders, screens

49. Smooth Sumac Rhus glabra (B, C, E, F, G)

description: native species, deciduous shrub or small tree, open flattened crown of a few stout spreading branches and whitish sap, pioneer species, suckers

hardiness zone: 2b

height: 6 m

diameter: 10 cm

leaves: pinnately compound, 11-31 leaflets, lance-shaped, saw-toothed, hairless, whitish beneath, red fall color

bark: smooth, brown

flowers: white, large, upright clusters

habitat: open uplands, edges of forests, grasslands, clearings, roadsides, waste areas, especially in sandy soils

use: sour fruit can be chewed to quench thirst, twigs and fruit eaten by small mammals

50. Black Spruce Picea mariana (A, C, G)

description: native species, evergreen trees with open irregular conical crown of short, horizontal or slightly drooping branches

hardiness zone: 1

height: 6-18 m

diameter: 0.1-0.3 m

needles: evergreen, stiff, 4-angled, ashy-blue green

bark: grey or blackish, scaly

cones: egg-shaped or rounded, dull grey and curved downward on short stalk, remains attached in clusters near crown of tree

habitat: wet soils and bogs including peats, clays and loams in coniferous forests, often in pure stands

use: lumber products, windbreak, massing

51. White Spruce *Picea glauca* (B, C, E, G)

description: native species, evergreen tree with rows of horizontal branches forming a conical crown

hardiness zone: 1

height: 12-30 m

diameter: 0.3-0.6 m

needles: evergreen, stiff, 4-angled, sharp-pointed, spreading mainly on upper side of twig, eluding skunk-like odor when crushed

bark: grey or brown, smooth or scaly

cones: cylindrical, shiny, light-brown, hanging at ends of twigs, falling at maturity

habitat: many soil types in coniferous forests, sometimes in pure stands

use: lumber products, foliage browsed by deer, rabbit, grouse; windbreaks, massing

52. Tamarack *Larix laricina* (A, B, C, E, G)

description: native species, deciduous tree, straight, upright form, tapering trunk, thin open conical crown of horizontal branches

hardiness zone: 1a

height: 12-24 m

diameter: 0.3-0.6 m

needles: deciduous, soft, very slender, 3-angled, crowded in cluster on spur twigs, and scattered and alternate on leader twigs, light blue-green color, yellow in fall

bark: reddish-brown color, scaly

cones: elliptical shape, rose-red color, turning brown with age, upright and stalkless, fall in second year of growth

habitat: wet, peaty soils of bogs and swamps, also on drier upland loamy soils, often in pure stands

use: ornamental/specimen trees, lumber products, massing for textural differences

53. Wayfaring Tree *Viburnum lantana* (A, B, E, F, G)

description: native species, deciduous shrub, attractive form, broad-oval

hardiness zone: 3

height: 3 m

leaves: light green, ovate, wrinkled above, tooth-like margins, with small, spiny projections on each tooth, hairy upper and lower surface, no fall color

bark: grey color

flowers: small, white, in terminal clusters

fruit: bright scarlet in mid-summer, ripens to uninteresting black color

habitat: moist soils of valleys and rocky uplands

use: ornamental, massings

54. Bebb Willow *Salix bebbina* (A, E, G)

description: much-branched, deciduous shrub or small tree with a broad rounded crown

hardiness zone: 2

height: 3.0-7.6 m

diameter: 15 cm

leaves: elliptical shape, often broadest beyond the middle, short-pointed at ends, dull green above, grey or whitish and net-veined beneath

bark: grey, smooth, becoming rough and furrowed

flowers: catkins with yellow or brown scales

fruit: slender capsules

habitat: moist open uplands and borders of streams, lakes and swamps

use: lumber products, shade tree, massing, windbreak

55. Bog Willow *Salix pyryolia* (A, C, G)

description: deciduous shrub, sometimes a tree, with clumps of slender stems, branched near the top, balsam fragrance

hardiness zone: 1a

height: 6 m

diameter: 10 cm

leaves: ovate or elliptical, short-pointed, dark green above, paler and whitish with yellow mid-vein below

bark: grey, smooth

flowers: catkins, yellowish color

fruit: dark orange capsules

habitat: cold, wet bogs

use: massings

56. Coyote Willow Salix exiqua (A, G)

description: thicket forming deciduous shrub with clustered stems, or rarely, a tree, with very narrow leaves, native species, drought resistant, spreads and grows rapidly

hardiness zone: 1a

height: 1-3 m, sometimes up to 6 m

diameter: 13 cm

leaves: linear, very long-pointed ends, yellow-green to grey-green color

bark: grey, smooth or becoming fissured

flowers: catkins

fruit: light-brown capsules

habitat: wet soils, especially along riverbanks, sandbars and silt flats

use: has the greatest range of all willows, drought-resistant, prevents soil erosion, useful as shelterbelt, foliage is consumed by livestock, wood is useful for basket-weaving

57. Peach-Leaf Willow Salix amygdaloides (A, C, E, G)

description: a deciduous tree with one or sometimes several straight trunks, upright branches and spreading crown

hardiness zone: 2b

height: 18 m

diameter: 0.6 m

leaves: lance-shaped, often slightly curved to one side, tapering to a long narrow point, finely saw-toothed, shiny green above, whitish beneath

bark: dark brown, rough, furrowed into flat scaly ridges

flowers: in catkins

habitat: wet soils of valleys, often bordering stream banks with Populus deltoides

use: prevents riverbanks from excessive erosion, useful shade tree specimen

58. Pussy Willow *Salix discolor* (A, E, F, G)

description: many-stemmed, deciduous shrub or small tree, with open rounded crown, silky, furry catkins appear in spring

hardiness zone: 1a

height: 6 m

diameter: 20 cm

leaves: lance-shaped or narrowly elliptical, irregularly wavy-toothed, shiny green above, whitish beneath

bark: grey, fissured and scaly

flowers: catkins, cylindrical, thick with blackish scales, covered with silky whitish hairs

fruit: narrow, light-brown capsules

habitat: wet meadow soils and borders of streams and lakes, usually in coniferous forests

use: windbreaks/massing, specimen tree

59. European White Willow *Salix alba* (A, C, E)

description: naturalized deciduous tree with one-four trunks and open crown of spreading branches

hardiness zone: 3a

height: 15-24 m

diameter: 0.6 m, or greater

leaves: lance-shaped to elliptical, finely saw-toothed, shiny dark green above, whitish, silky beneath, yellow fall color

bark: grey, rough, furrowed into narrow ridges

flowers: catkins

fruit: hairless capsules

habitat: wet soils of stream banks and valleys near cities

use: shade tree, ornamental, shelterbelts, lumber products

IV. Plants With Distinctive Characteristics

1. Colored Fall Foliage:
   a. Red Shades: American Cranberry Bush, Amur Maple, Dogwoods, Downy Viburnum, Early Lilacs, Euonymus, Mountain Ash, Hedge Cotoneaster, Nannyberry, Pincherry, Saskatoon, Siberian Currant, Smooth Sumac, Snowhite Spirea, Ussurian Pear, Virginia Creeper, Englemann Ivy.

   b. Yellow Shades: Ashes, Basswood, Birches, Poplars, Siberian Larch.

2. Colored Summer Foliage:
   a. Blue: Blue Danube Juniper, Colorado Spruce, Dunvegan Blue Juniper, Rocky Mountain Junipers.

   b. Purple: Cistena Plum, Shubert Chokecherry, Thunderchild Crabapple.

   c. Silver: Coyote Willow, Leadplant, Seabuckthorn, Silky White Willow, Silverberry, Silver Buffaloberry.

   d. Variegated: Creamedge and Yellowedge Dogwoods.

   e. Yellow: Golden Ninebark, Golden Pfitzers Juniper, Sutherland Golden Elder.

3. Showy Bark: Amur Chokecherry (bronze), Birches (white except Water), Common Ninebark (peeling), Dogwoods (red, yellow), Japanese Tree Lilac (purple), Maack Euonymus (mottled grey), Pincherry (purple), Willow (red, yellow).

4. Showy Bloom: Brooms (purple, yellow), Chokecherries (white), Clematis (purple, yellow), Crabapples (pink, white), Daphne (pink), Falsespirea (white), Genista (yellow), Hawthorns (white), Honeysuckles (pink, red, white), Hydrangeas (white), Lilacs (bluish, cream, pink, purple, violet, white), Mock-oranges (white), Mountain Ash (white), Plums (pink, white),

IV. Plants With Distinctive Characteristics - Continued

Roses (pink, red, white, yellow), Saskatoons (white), *Spireas* (pink, white), Tamarisk (pink), Ussurian Pear (white), Viburnums (white), Weigela (pink).

5. Showy Fruit: Acanthopanax (black), Amur maple (red), Bittersweet (red/yellow), Cherry Prinsepia (red), Common Ninebark (red), Cotoneaster (black, red), Crabapples (red, yellow, green), Euonymus (pink/red), European Red Elder (red), Hawthorns (black/red), Honeysuckles (red), Mountain Ash (red), Roses (black, red), Seabuckthorn (yellow), Silver Buffaloberry (red), Viburnums (black, red).

6. Acid Tolerant Species (most are native species): American Red Currant (*Ribes triste*), Blueberry (*Vaccinium angustifolium*), Bog Laurel (*Kalmia polifolia*), Checkerberry Wintergreen (*Gaultheria procumbens*), Labrador Tea (*Ledum groenlandicum*), Lapland Rhododendron (*Rhododendron lapponicum*), Mooseberry (*Viburnum pauciflorum*), Red Maple (*Acer rubrum*), Rock Cranberry (*Vaccinium vitis-idaea minus*), Sweetgale (*Myrica gale*).

7. Alkali Tolerant: Amorpha, Caraganas, Colorado Spruce, Lilacs, Potentillas, Rocky Mountain Junipers, Seabuckthorn, Siberian Salttree, Silverberry, Silver Buffaloberry, Tamarisk, Threelobe Spirea.

8. Bank Stabilization: Albert Thorn Honeysuckle, Creeping Junipers, Dr. Merkeley Rose, Russian Almond, Ural Falsespirea Willows.

9. Species Suitable for Northern Areas: Amur Maple, Coronation Triumph Potentilla, Creamedge, Redosier and Yellow-twig Dogwood, Eastern Larch, Globe and Pygmy Caragana, Late Lilacs, Laurel and Silky White Willow, American and Showy Mountain Ash, Northwest Poplar, Paper Birch, Roses, Sweetberry and Tatarian Honeysuckle as well as all native species.

IV. Plants With Distinctive Characteristics - Continued

10. Shade Tolerant: Arborvitao, Aurora Falsespirea, Currants, Dogwoods, Dwarf Euonymus, Hedge Cotoneaster, Honeysuckles, Hydrandeas, Saskatoons, Viburnums.

11. Tolerant of Hot, Dry Conditions: Amorphas, Brooms, Caraganas, Cherry Prinsepia, Hedge Cotoneaster, Junipers, Ninebarks, Seabuckthorn, Siberian Salttree, Silver Buffaloberry, Smooth Sumac, Tamarisk.

12. Tolerant of Sandy Well-Drained Soils: Balsam Fir, Bearberry, Canada Yew, Ponderosa Pine, Red Pine.

V. Grasses

i) Introduction:

- grassland communities offer abundant "design" possibilities, especially on the prairies, where redevelopment of "historic" or natural landscapes are often desired.
- establishment of native grasses or turf, which are ornamental grasses, is relatively easy, i.e. from seed or pre-cut sod.
- a number of North American nurseries provide native seeds that may be purchased.

ii) Common Turf Grasses:

a. Perennial Ryegrass
  - rapid germination
  - provides protection for other grasses as they become established
  - with normal mowing, disappears after second year

b. Annual or Italian Ryegrass
  - fast growth rate
  - annual grass

c. Norlea Ryegrass
  - perennial grass
  - fine-textured leaf, dark blue-green color
  - excellent companion for bluegrasses

d. Kentucky Bluegrass
  - soft, dark green grass
  - favours sunny open areas with well-drained, moderately heavy clay-type soils of high fertility
  - requires two-three years to fully establish itself
  - good disease resistance, thick, creeping growth habit
  - most commonly used in residential planting

V. Grasses - Contined

e. Canada Bluegrass
  - not as dense as Kentucky Bluegrass, but grows better on lighter less fertile soils than (k)
  - should not be used indiscriminately in lawn mixes but can be a desirable addition in problem areas, i.e. sand areas, hillsides, etc.

f. Merion Bluegrass
  - is a strain of Kentucky Bluegrass
  - has good disease resistance
  - fast germination
  - alone, or in combination with other species will produce a good bluegrass-type lawn

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NOTE: - bluegrass is the variety most suited to prairie conditions and is aggressive under normal conditions. Usually becomes predominant in any stand, by virtue of its growth and reproductive habits.
- attractive, most commonly used.

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g. Poa Trivialis
  - soft-textured, permanent grass
  - light green in color
  - adapted to moist, shady areas

h. Creeping Red Fescue
  - vigorous growth habit
  - fine texture grass
  - rolled leaf form
  - creeping characteristic

V. Grasses - Contined

- grows well in moist soils, but favours sandy soils
- adapted to both sunny or shaded locations
- perennial

i. Chewings Fescue

- similar in all characteristics to Creeping Red Fescue, except slightly superior under adverse conditions

j. Pennlawn Fescue

- slightly wider leaf than the Creeping Red Fescue, making it more attractive
- blends well with other grasses
- grows well on sandy soils, tolerates low fertility or shaded locations
- high disease resistance

k. Alta and Kentucky 31 Fescue

- coarser than other Fescue species, and not widely used for lawns
- definite place in athletic fields, playgrounds, where deep-rooted, hardy grass is a necessity
- used on hillsides where erosion is a problem

l. Colonial Bentgrass

- not generally planted alone, but may be
- with proper care and abundant water, it will produce a fine, soft permanent turf
- spreads by means of underground root stalks and does especially well on wet, acid soils
- primarily used to provide a fine, soft undergrowth in fescue and bluegrass mixes
- requires close clipping

V. Grasses - Contined

m. New Zealand Brown Top
  - superior bentgrass, produces a fine velvety lawn
  - strong creeping root system
  - thrives under close clipping and with moisture will produce an outstanding lawn

n. Astoria Bentgrass
  - same as New Zealand Brown Top except seed is from the United States

o. Seaside Creeping Bentgrass
  - for bowling and putting greens used with one of the preceeding species
  - can be started from seed
  - enjoys plenty of food, moisture and care

p. Penncross
  - excellent disease resistance
  - hardy

q. Red Top
  - fast starting
  - excellent companion for slower starting varieties, since it tends to disappear after two or three years
  - usually used in lawn bowling or golf greens

V. Grasses - Contined

iii) White Dutch Clover:

- is not a member of any grass family, but under certain conditions, a small amount (2%-3%) may be desirable in grass mixture
- part of the legume family
- aids in introducing nitrogen to the soil, thus improving the fertility for grass species
- when moisture is not available, clover maintains its color better than the grasses
- in a good lawn, however, it gives an uneven color or patchy appearance
- stains clothing
- should not be introduced in the establishment of fine turf areas

VI. Flowering Plants

i) Introduction:

- native flowering plant species available at nurseries in seed form
- alternative is perennial or annual bedding plants
- the use of annuals permits flexibility in the planted area, by varying color, texture, fragrance
- perennials offer permanence and minimal maintenance
- to establish flowering plants, recommend a soil ph between 5.8-7.0, and a friable, sandy loam soil, rich in leaf mulch
- native flowering plants are particularly well adapted to a low maintenance landscape (especially meadow and prairie wildflower species in combination with companion cover crops)
- many "ideal" locations where native meadow and prairie mixes can be used, i.e. roadslopes, highway verges where steep, dry slopes make mowing difficult, etc.
- meadow and prairie wildflowers, along with their companion grass species are long-lived perennials, which self-seed freely, have deep roots capable of withstanding low moisture conditions, and, for the most part, are disease free
- flowering plants require little or no fertilizer, since it leads to coarser plants
- areas with 60%-70% full sun (west or east exposures) are ideal
- ideal for redevelopment of areas, but cannot tolerate heavy use (compaction)

VI. Flowering Plants - Continued

ii) Herbacious Annuals and Perennials/Definitions:

a. Annual - an annual is a plant that lives but one season from seed sowing to flowering, setting of seed, and death.

b. Perennials - a herbacious perennial is a plant which lives for several years, whose top dies or enters a dormant stage during winter, but is renewed from the same roots each spring.

iii) Uses:

- the use of annuals permits flexibility by varying color, texture, fragrance of planted area every year
- perennials offer permanence with less overall cost

iv) Preparation of Flowering Plant Bed:

- most annuals and perennials will prefer near-normal reaction soil, probably in the sandy loam category, with excellent drainage and a well-balanced level of nitrogen, phosphorus and potash
- the area to be used should be tilled and prepared to about 30 cm-46 cm in depth, and the soil should be moist but not wet at planting time

v) Common Flowering Plants and Characteristics:

Low-Growing Plants 10 cm - 26 cm in height

Name	Height	Colour	Remarks
Alyssum (carpet of snow)	15 cm	White	useful for narrow border or mat type of ground cover/ rockeries
(rosie o day)	15 cm	Pink	
(royal carpet)	15 cm	Purple	
Argeratum (midget blue)	20 cm	Blue	border planting, group planting, or ground cover
(blue cap)	20 cm	Blue	
(fairy pink)	20 cm	Salmon Pink	
Asters (kirkwell dwarf)	15 cm	White	useful as group planting
Dianthus (pinks) (bravo)	15-25 cm	Pink Blue Varied	border planting, group planting, or ground cover
Lobelia (rosamond)	15 cm	Carmine Red	border planting, group planting, or ground cover
(crystal palace)	15 cm	Dark Blue	
(white lady)	15 cm	White	
Marigold (petites)	15 cm	Yellow	border or group planting
Phlox (twinkle)	20 cm	Varied	group planting or ground cover
(ideal nana)	20 cm	Colour	
Phacelia (California bluebell)	25 cm	Blue	group planting, rockeries
Portulaca (double mixed)	15 cm	Blue-Pink	ground cover, spreading habit requires strong sun, rockeries
Salvia (fireball)	25 cm	Red	group planting
Centura (dusty millar)	20-25 cm	No flower	grey silver foliage, excellent contrasting border
Marigold (Naughty Mariotta)	25 cm	Yellow	group plant, border or display

Intermediate Height Plants 25 cm - 60 cm in height

Name	Height	Colour	Remarks
Antirrhinum (snapdragon)	45-50 cm	Varied	group planting) excellent
(sprites)			) for
(paradise rose)	50-60 cm	Pink	group planting) cut flower
Antirrhum (snapdragon)			
yellow giant	50-60 cm	Canary	group specimen planting
apple blossom	50-60 cm	Rose Pink	excellent for cut flowers
copper king	50-60 cm	Bronze	
campfire	50-60 cm	Scarlet	
Asters (Queen of the	45-50 cm	Scarlet	good height to prevent stem
Market)	45-50 cm	Purple	breaking, group plant, good
	45-50 cm	Rose	large colourful flower
	45-50 cm	Yellow	excellent for cutting
Begonia fibrous or tuberous rooted	30 cm	Pink Yellow White	group of specimen planting must be shady location
Calliopsis (golden crown)	38 cm	Yellow	group plant, continuous
	38 cm	Red	bloom, daisy like flower
Carnation (marguerite)	45-50 cm	Mixed	group plant, late fall bloom
Celosia (fireglow)	50 cm	Scarlet	group plant, constant bloom
Dianthus pinks (double gaiety)	30-38 cm	Salmon	group planting, good flower
(westwood beauty)	30-38 cm	Red	group planting, stands heat best
Cynoglossum (forget-me-not)			group planting, all season
(firmament)	38 cm	Blue	bloom
Marigold (spun yellow)	30 cm	Yellow	group planting, good cut
(spun gold)	30 cm	Yellow-Gold	flower
Nasturtiums (yellow gleam)	50-60 cm	Yellow	group planting, good
(firey festival)	50-60 cm	Scarlet	fragrance
Pansy (collosal F2 hybird)	30-38 cm	Mixed	group planting, strong
(snow dream)	30-38 cm	White	colour, dream series are one
(golden dream)	30-38 cm	Copper	colour, continuous bloom
(fire dream, etc.)	30-38 cm	Scarlet	

Intermediate Height Plants 25 cm - 60 cm in height

Name	Height	Colour	Remarks
Petunia (doubles, all colours)	30-45 cm	Varied	group planting, long bloomer
(grandiflora F1 hybird all colours)	30-45 cm	Varied	group plant, extra large, good colourful flower, ragged appearance
Phlox (salmon glory)	38 cm	Salmon	group planting, withstands heat and full sun, long blooms
(rosy morn)	38 cm	Pink	
(red glory)	38 cm	Red	
Salvia (blaze of fire)	38 cm	Red	group planting
(blue bedder)	60 cm	Blue	good contrast colour plant
Verbena (snow queen)	30 cm	White	group planting, stands sun and resists late frost
(salmon queen)	30 cm	Salmon	
(firelight)	30 cm	Red	
Zinnia lilliput	45 cm	All Colours	group plant, good for cut flowers, group plant, good cut flowers, envy is a unique colour used for contrast
(pink buttons)	30 cm	Pink	
(red buttons)	30 cm	Red	
(envy)	30 cm	Green	
Geranium (potted)	30 cm	Pink	specimen plant or group plant, constant bloom, excellent for planting, strong sun
	30 cm	White	
	30 cm	Scarlet	
Grassina (potted)	45-60 cm	No Flower	sword like foliage, excellent contrast for geranium
Chrysanthemum (potted)	30-60 cm	Red	group plant excellent for planters and cut flowers
	30-60 cm	White	
	30-60 cm	Bronze	
Bleeding Heart	30-60 cm	Pink	specimen plant, ferny foliage, likes shade

Large Plants 60 cm and Over

Name	Height	Colour	Remarks
Coleus (rainbow)	60 cm	Mixed	group planting, background plant
Cosmos (sunset)	91 cm	Red	group planting background plant will bloom until fall
(purity)	91 cm	White	

Large Plants 60 cm and Over

Name	Height	Colour	Remarks
Dahlia (coltness Scarlet)	76 cm	Red	group planting, background plant, good cutting flower
(coltness Gem)	76 cm	Yellow	
Delphiniums (percival)	76-91 cm	White	group planting, large flowers, easily grown, protect from strong wind
(blue bird)	76-91 cm	Light Blue	
(Guinevere)	76-91 cm	Pink	
(King Arthur)	76-91 cm	Violet	
(black night)	76-91 cm	Deep Blue	
Nicotine (affinis mixed)	60 cm	Mixed	group plant, flower opens in evenings
(sensation mixed)	60 cm	Mixed	group plant, flowers all day
Scabiosa (Caucasica home hybird)	60 cm	Lavender	group planting, background plant, long stemmed plant
	60 cm	Blue	
	60 cm	White	
Stocks (early grant imperial)			
(santa maria)	76 cm	White	group planting, rosette like flowers, good fragrance
(redwood)	76 cm	Crimson	
(tahoe)	76 cm	Lavender	
Michaelmas Daisy (aster hybird)	60-91 cm	Mixed	excellent background plant
Peony (Karl Rosenfeld)	60 cm	Red	very large showy flowers, group plant, interplant annuals
(Festiva Maxima)	60 cm	White	
Euphorbia (snow on the mountain)	60 cm	No Flower	green and white foliage plant
Cannas (King humbert)	60-91 cm	Scarlet	bronze foliage) large
(The president)	60-91 cm	Scarlet	green foliage) upright) specimen) plant
Tiger Lily (common)	24-36"	Orange	easy to grow, good visual effect

VII. Sources of Native Plant Materials

Nursery	Type of Plant Materials
High Meadow Farm c/o Tom & Molly Murray 3191 Highway P, Route 9 Mount Horeb, Wi. 53572 U.S.A.	native shrubs and herbaceous plants
LaFayette Home Nursery, Inc. LaFayette, Il. 61449 U.S.A.	prairie species, grasses and forbs and mixes
The Potting Shed P.O. Box 11638 Milwaukee, Wi. 53211 U.S.A.	mostly prairie species, some woodland species, seed only
Prairie Associates c/o David M. Peterson 6328 Piping Rock Road Madison, Wi. 53964 U.S.A.	prairie species, grasses and forbs, seed and plants
Prairie Ridge Nursery Rt. 2 9738 Overland Road Mount Horeb, Wi. 53572 U.S.A.	prairie species, seed and plants
Sperka's Woodland Acres Rt. 2 Crivitz, Wi. 54114 U.S.A.	wide variety of woodland wetland and prairie species, plants
Wildlife Nurseries P.O. Box 399 Oshkosh, Wi. 54901 U.S.A.	pond, marsh and wetland species, roots, tubers and seed depending on species
Windrift Prairie Shop c/o Doug & Dorothy Wade Oregon, Ill. 61108 U.S.A.	prairie species, grasses and forbs, seed and plants